# Zanesljivost mobilne aplikacije za merjenje obsega gibljivosti sklepov

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**Uvod:** Goniometrične meritve se uporabljajo za določanje točnega položaja sklepa in celotnega obsega giba v sklepu (5). Obstajajo različni načini merjenja obsega gibljivosti sklepov, najpogosteje pa se za ugotavljanje obsega gibljivosti kolenskega sklepa uporablja univerzalni goniometer. Zadnja leta se uveljavljajo načini merjenja, ki delujejo na podlagi analize digitalne fotografije, vendar te metode zahtevajo zapleten postopek, ki pa je z razvojem pametnih telefonov postal enostavnejši (1). Aplikacija DrGoniometer (DrG) na pametnem telefonu deluje kot virtualni goniometer, omogočala naj bi enostavnejše in hitrejše meritve obsega sklepne gibljivosti (2). Nove aplikacije je treba preveriti, predvsem njihovo zanesljivost in veljavnost (4). **Metode:** V raziskavo je bilo vključenih 31 preiskovank, starih od 18 do 25 let, brez predhodnih poškodb in obolenj merjenega kolenskega sklepa. Meritve so bile opravljene dvakrat, z vmesnim premorom 48 ur. Preiskovanka je ležala na hrbtu, na preiskovalni mizi, visoki 70 centimetrov. Pasivni gib je izvedla druga preiskovalka. Merilo se je po protokolu Jakovljević in Hlebš (3). Za statistično analizo je bil uporabljen intraklasni korelacijski koeficient (ICC) s 95-odstotnim intervalom zaupanja in minimalno zaznano spremembo. **Rezultati**: Zanesljivost preiskovalca pri mobilni aplikaciji je bila odlična tako pri merjenju pasivnega obsega fleksije ICC = 0,932 (95-odstotni interval zaupanja: 0,856–0,968) kot ekstenzije ICC = 0,910 (95-odstotni interval zaupanja: 0,812–0,957), $p < 0,001$. Minimalna zaznana sprememba pri merjenju pasivnega obsega ekstenzije je znašala 3,2° in pasivnega obsega fleksije 5,1°. **Zaključki:** Meritve obsegov gibljivosti sklepov z mobilno aplikacijo DrG so se izkazale kot odlično zanesljive tako pri merjenju ekstenzije kot pri merjenju fleksije v kolenskem sklepu. Podobna raziskava, v kateri so za merilni instrument prav tako uporabili aplikacijo DrG, navaja rezultate zanesljivosti preiskovalca pri merjenju obsega fleksije kolenskega sklepa ICC = 0,958 (2), ki so povsem primerljivi z našimi rezultati. Kljub zanesljivim rezultatom te raziskave sta za uporabo v klinični praksi potrebna dodatna standardizacija postopkov in sledenje določenemu protokolu, saj v splošnem za to tehniko ni definiran. Pomanjkljivost raziskave je, da je bila izvedena na zdravih posameznikih, na katerih je bila postavitev virtualnega goniometra lažje izvedljiva, kot bi bila v primeru čezmerno težkih bolnikov ali bolnikov s kostnimi deformacijami. Primerno bi bilo, da se izvedejo dodatne raziskave, ki bi vključevale tudi paciente in ne le zdrave posameznike.

**Ključne besede**: sklepna gibljivost, mobilna aplikacija, zanesljivost preiskovalca.

# Reliability of mobile application for measuring joint range of motion

**Background:** Goniometric measurements are used to define precise joint position and joint range of motion (5). There are many different possibilities of range of motion measurements, but the classic handheld goniometer is the most common to measure knee range of motion. In the previous years, a new goniometry technique, which functions on the basis of digital photography analysis, has been established and the difficult process has also been simplified by the smart-phone revolution (1). The smart-phone application DrGoniometer (DrG) works on smartphones as a virtual goniometer, which offers easier and faster measurements of joint range of motion (2). However, the reliability and validity of these smart-phone applications must be verified (4). **Methods:** The study was conducted on a sample of 31 healthy female student volunteers, 18–25 years old, with no history of knee injuries or disease. The measurements were conducted twice within 48 hours. During the measurement, the subject was lying in a supine position on a table, 70 cm from the ground. The passive movement was carried out by the second physiotherapist. The protocol of Jakovljević and Hlebš was used (3). Agreement between two sets of measurements was assessed using intraclass correlation coefficient (ICC) with 95% confidence interval. Minimal detectable change was also calculated. **Results**: Intrarater reliability for smart-phone application showed excellent reliability when measuring passive flexion ICC=0.932 (95% confidence interval: 0.856–0.968) and passive extension ICC=0.910 (95% confidence interval: 0.812–0.957), $p<0.001$. Minimal detectable change values were 3.2° for extension measurements and 5.1° for flexion measurements. **Conclusion:** Smart-phone application DrG measurements of knee ROM show excellent intrarater reliability for both passive extension and passive flexion. A similar study from 2013 (2) suggests reliability of DrG when measuring knee ROM (ICC=0.958), which is comparable with the results of this study. Despite the good reliability of DrG in this study, it is necessary to determine a standard protocol for clinical use. A limitation of this study is that the participants were only healthy subjects, which made it easier to place a virtual goniometer than it would be in the case of overweight patients or patients with limb deformations. It would be good to conduct more research with patients, not only healthy subjects.

**Key words**: range of motion, smart-phone application, intrarater reliability.

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# Učinki kurkumina kot dodatka k fizioterapiji pri osebah z artrozo – pregled literature

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**Uvod:** Artroza je eden glavnih vzrokov za omejeno fizično zmogljivost in slabšo kakovost življenja ljudi. Za artrozo ni zdravila, cilji zdravljenja so zmanjšanje bolečine, ohranjanje ali izboljševanje sklepne gibljivosti ter povečanje mišične zmogljivosti. Pri farmakološkem zdravljenju artroze se najpogosteje uporabljajo nesteroidna protivnetna zdravila, ki pa pogosto povzročajo neželene stranske učinke, zato so raziskave usmerjene v iskanje alternativnih, predvsem naravnih, netoksičnih spojin. Številne molekularne in nekaj kliničnih raziskav potrjujejo pozitivne antiinflamatorne, antioksidativne in antikatabolne učinke kurkumina, ki ga lahko uporabimo kot dodatek pri zdravljenju artroze (1, 2, 3, 4, 5). **Metode dela:** Iskanje znanstvene literature je potekalo v podatkovni bazi PubMed, in sicer z naslednjimi ključnimi besedami: osteoarthritis and curcumin ter osteoarthritis and curcumin and exercise. Iskanje je bilo omejeno na prosto dostopne članke oziroma raziskave v angleškem jeziku v obdobju med letoma 2000 in 2016 ter na raziskave, ki so vključevale preiskovance z artrozo. **Rezultati:** Glede na vključitvena merila je bilo vključenih šest raziskav, ki so vključevale učinke kurkumina z dodatki (npr. glukozamin, hondroitin itn.) ali brez njih pri pacientih z artrozo kolena. Rezultati obravnavanih raziskav so pokazali, da je kurkumin lahko učinkovito in varno zdravilo pri bolnikih z artrozo za zmanjševanje bolečine in posledično izboljšanje funkcije. **Zaključki:** Izziv preiskovalcev je slaba absorbcija in biološka razpoložljivost kurkumina, zato je bilo v literaturi opisanih že nekaj poskusov izdelave preparata z izboljšanimi navedenimi lastnostmi, vendar pa so potrebne še nadaljnje dobro načrtovane randomizirane kontrolirane raziskave s preverjanjem dolgotrajnih učinkov. Na enak način je treba določiti še minimalni dnevni odmerek z maksimalnim terapevtskim učinkom.

**Ključne besede:** artroza, kurkumin, vadba.

# Effects of curcumin in addition to the physiotherapy in patients with osteoarthritis – literature review

**Background:** Osteoarthritis (OA) is one of the major causes of physical disability and it influences the quality of life. There's no cure for OA, the goals of treatments are reducing the pain, maintaining or improving range of motion and improving muscle capacity. With regard to pharmacological treatments non-steroidal anti-inflammatory drugs (NSAID) are the most often used treatment for OA, but they frequently cause adverse events, so alternative remedies, especially natural non-toxic compounds are under investigation. Many preclinical and only a few clinical studies showed positive anti-inflammatory, anti-oxidative and anti-catabolic effects of curcumin that can be used as an accessory therapy in OA treatment (1, 2, 3, 4, 5). **Methods**: Literature search was done using PubMed database and was limited to free accessible studies in English language on OA patients in the period 2000 – 2016. Key words used in English were: osteoarthritis and curcumin and osteoarthritis and curcumin and exercises. **Results:** Six studies on curcumin with or without associated compounds (i.e., glukozamine, chondroitine etc.) in knee OA patients were reviewed according to the inclusion criteria. Results showed that curcumin is a potential effective and safe treatment for OA patients to decrease pain and consequently improve function. **Conclusions:** Poor absorption and bioavailability of curcumin remains the main challenge for investigators. Several attempts have been described to improve the above mentioned properties of curcumin, but further randomized controlled clinical trials with long-term follow-up should be conducted. Minimal daily dose with maximal therapeutical effect should be also determined in the same manner.

**Key words**: osteoarthritis, curcumin, exercise.

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# Zdravljenje težkih hemofiličnih artropatij kolenskega sklepa

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**Uvod**: Pri osebah s hemofilijo je kolenski sklep zaradi pogostih krvavitev vanj najpogosteje prizadet. (1) Prihaja do hudih artropatij, ki prizadenejo predvsem funkcijo in povzročajo stalno bolečino. Vstavitev totalne kolenske endoproteze močno vpliva na izboljšanje obsega gibljivosti ter na zmanjšanje omejitev. (2) Namen raziskave sta bili pred- in pooperativna ocena rezultatov lestvic KOOS (Knee Injury and Osteoartrithis Outcome Score) in KSS (Knee Society Score) pri primarnih in revizijskih vpetih totalnih kolenskih endoprotezah na Ortopedski kliniki v letih od 2010 do 2015. **Metode**: Raziskava vključuje 14 totalnih kolenskih endoprotez, opravljenih med letoma 2010 in 2015, pri 12 osebah moškega spola s hemofilijo. V desetih primerih je bila vstavljena primarna, pri štirih pa revizijska vpeta totalna kolenska endoproteza. Povprečna starost oseb ob operativnem posegu je bila 48 let (od 26 do 64 let), povprečen čas od operativnega posega pa 28 mesecev (od 4 do 56 mesecev). Raziskavo sva izvedla ortoped in fizioterapevtka, tako da sva vsak naredila svoj strokovni del. Rezultate sva nato obdelala in primerjala predoperativni in pooperativni rezultat opravljenih lestvic KOOS in KSS. Lestvica KOOS obsega pet sklopov: 1. bolečina, 2. simptomi, 3. vsakodnevna opravila, 4. šport in rekreacija ter 5. kakovost življenja. Lestvica KSS je sestavljena iz dveh delov: 1. ocena kolenskega sklepa (bolečina, fleksijska kontraktura, ekstenzijska kontraktura, obseg fleksije, osna deformacija, stabilnost) in 2. ocena funkcije (prehojena razdalja, hoja po stopnicah, uporaba pripomočkov za hojo). Pri dveh izmed štirinajst posegov oseba na svojo željo ni bila vključena v pred- in pooperativno rehabilitacijo, temveč je bila deležna le bolnišnične rehabilitacije. Vse obravnave so bile individualne in so vključevale metode fizikalne terapije, kinezioterapije in manualne terapije. **Rezultati**: Rezultati so odlični, saj se je na lestvici od 0 do 100 povprečna vrednost lestvice KOOS zvišala z 41 na 86 točk, povprečna vrednost lestvice KSS pa s 40 na 78 točk. **Zaključki**: Vstavitev totalne kolenske endoproteze pri osebah s hemofilijo pomembno vpliva na izboljšanje funkcije osebe in ji tako močno spremeni kakovost življenja.

**Ključne besede:** hemofilija, vpeta totalna kolenska endoproteza, funkcija, kakovost življenja.

# Treatment of severe haemophilic arthropathy of the knee joint

**Introduction**: People with haemophilia frequently suffer from bleeding into a knee joint, a joint that is most susceptible to their diagnosis. (1) People suffer from arthropathies which affect function and cause constant pain. Total knee arthroplasty (TKA) has a major impact on improving the range of motion and reducing restrictions.(2) The purpose of this study is preoperative and postoperative evaluation of KOOS (Knee Injury and Osteoartrithis Outcome Score) and KSS (Knee Society Score) score results in primary and revision hinged TKA at the Ljubljana Orthopaedic Clinic from 2010 to 2015. **Methods**: This study includes 14 hinged TKA carried out between 2010 and 2015 with 12 male subjects with haemophilia. In ten cases a primary TKA was performed and in four cases a revision TKA. The average age of patients at the time of surgery was 48 years (from 26 to 64 years). The average time from surgery was 28 months (from 4 to 56 months). The research was conducted with an orthopaedic surgeon and a physiotherapist. We then processed results and compared preoperative and postoperative outcome of KOOS and KSS scales. KOOS scale comprises of five parts (1. Pain, 2. Symptoms, 3. Function in daily living, 4. Function in sports and recreation, 5. Knee related quality of life). KSS scale is composed of two parts; 1. Knee score (pain, flexion contracture, extension lag, total range of flexion, alignment, stability) and 2. Function (walking, stairs, walking aids used). In two of the 14 interventions a patient, at his own request, did not want to be included in the preoperative and postoperative outpatient rehabilitation, but has received only inpatient rehabilitation. All treatments were individual and included methods of physical therapy, kinesiotherapy and manual therapy. **Results**: Results are excellent. Average value of the KOOS scale increased from 41 points preoperatively, to 86 points postoperatively on a scale from 0 to 100. The average value of KSS increased from 40 preoperatively, to 78 points postoperatively. **Conclusions**: TKA in patients with haemophilia has a significant impact on improving the function and thus significantly changes the quality of life.

**Key words**: haemophilia, hinged total knee arthroplasty, function, quality of life.

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# Objektivni in subjektivni rezultati po rekonstrukciji sprednje križne vezi ob uporabi presadka kit fleksorjev

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**Uvod**: Po rekonstrukciji kolenskega sklepa s kitami fleksorjev ter po intenzivni rehabilitaciji pred operacijo in po njej se bolniki lahko v kratkem času vrnejo na predpoškodbeno raven funkcionalnih aktivnosti (1). Obstaja več načinov testiranj, s katerimi ocenimo uspešnost operacije in rehabilitacije. Ne glede na rezultate objektivnih testiranj pa je najpomembnejše subjektivno mnenje bolnika, ki mu je bila narejena rekonstrukcija. V raziskavi smo merili in primerjali rezultate zdrave in operirane noge ter medsebojne povezave med objektivnimi in subjektivnimi meritvami šest mesecev po operaciji sprednje križne vezi. **Metode dela**: Sodelovalo je 65 zdravih bolnikov po operativni rekonstrukciji sprednje križne vezi s fleksorji kolenskega sklepa, s pridruženo poškodbo meniskusa in/ali hrustanca ali brez nje, brez radioloških sprememb in brez predhodnih operacij operirane ali nasprotne noge. Meritve so bili izvedene šest mesecev po artroskopiji kolenskega sklepa. Moč mišic kolenskega sklepa je bila merjena na izokinetičnem dinamometru Biodex 4 pro, ravnotežje je bilo merjeno s sistemom Biodex balance, objektivna stabilnost pa z artrometrom KT-1000. Od funkcionalnih testov smo uporabili enonožni skok v daljino – hop test. Za subjektivno oceno kolenskega sklepa smo uporabili Lysholomov vprašalnik in Tegnerjevo lestvico aktivnosti. **Rezultati:** Pri primerjavi rezultatov subjektivnega vprašalnika z večino objektivnih testov nismo našli statistično značilne razlike ($p > 0,05$). Statistično značilno razliko smo ugotovili le pri hop testu, pri katerem je korelacijski koeficient znašal 0,285, kar kaže na rahlo pozitivno povezanost. Pri primerjavi rezultatov zdrave in operirane noge smo ugotovili, da je razlika statistično značilna ($p < 0,05$). Izjema je bila le razlika pri testu ravnotežja ($p = 0,922$). **Zaključki**: Rezultati po rekonstrukciji sprednje križne vezi s kitami fleksorjev kolenskega sklepa po šestih mesecih niso primerljivi z rezultati nasprotne, zdrave noge. Povezav med objektivnimi in subjektivnimi testi ni, razen pri testu ravnotežja. Ta trditev je mogoče posledica dejstva, da slabih rezultatov pri subjektivni oceni ni bilo.

**Ključne besede**: sprednja križna vez, izokinetika, KT-1000, rekonstrukcija, subjektivni vprašalniki.

# Objective and subjective results after anterior cruciate ligament reconstruction using hamstring tendons

**Background:** When the reconstruction with flexors tendons is made and patients have intensive pre- and post-surgery rehabilitation, they can return to the pre-injury level of functional activity in short term (1). Rehabilitation process and physiotherapy require insight into the subjective consequences as perceived by the patients in addition to the assessment of impairments by clinician-based measures. We collected subjective and objective predictors of functional knee joint performance in ACL reconstructed patient 6 months after operation. We compared the results of the operated and non-operated knee and subjective assessment with normative values. **Methods:** Sixty-five healthy subjects after unilateral ACL reconstruction with flexor tendons, with or without meniscal or/and chondral lesions, without radiographically seen abnormality, and without any operations on the legs before reconstruction, were included in this study. For follow-up measurements 6 months after ACL reconstruction we used the following measurement tools: isokinetic strength of the knee joint measured by the isokinetic dynamometer Biodex 4 pro, dynamic postural stability of the subject measured with the Biodex Stability System, and objective anterior-posterior knee laxity measurements performed with the KT-1000 arthrometer. One-legged hop test was used to assess functional performance. For subjective assessment we used Lysholm and Tegner questionnaire. **Results:** Statistically significant differences at functional performance measures were found between operated and non-operated leg ($P<0.05$), except for Balance results ($P=0.922$). Mean score of Lysholm questionnaire (5) was 93.8 points, their classification was found to correlate to the total score of normative values of Lysholm scale. The mean score for Tegner questionnaire (6) was 6. 55.4% patients have already returned to the pre-injury level of functional activity. **Conclusion:** Objective results of ACL reconstructed knees with flexors tendons at 6 months after surgery were very good and comparable to those of the opposite, healthy knees. The effectiveness of good rehabilitation and physiotherapy approach confirms higher scores of subjective scales.

**Key words**: anterior cruciate ligament, isokinetic testing, KT-1000, reconstruction, questionnaire.

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# Kako poškodba spodnjega uda vpliva na ravnotežje pri športnikih, ki trenirajo atletiko

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**Uvod:** Poškodbe spodnjih udov vplivajo na kontrolo drže športnika. Za namen hitrega in enostavno dostopnega, kliničnega ocenjevanja ravnotežja je mogoča uporaba BESS (Balance Error Scoring System) in SEBT (Star Excursion Balance Test). Za oba testa literatura navaja, da sta veljavna in zanesljiva merilna pripomočka za odkrivanje poškodb spodnjih udov in posameznikov z večjim tveganjem (1, 3). Športniki, ki trenirajo atletiko, so bolj nagnjeni k poškodbam spodnjega uda in vračanju k aktivnosti z deficiti v ravnotežju (4). Testiranje statičnega in dinamičnega ravnotežja ter telesne kontrole bi lahko razkrilo poslabšanje ravnotežja pri skupini poškodovanih atletov oziroma pokazalo na razlike med poškodovanim in nepoškodovanim udom skupine poškodovanih atletov. **Metode:** V raziskavi je sodelovalo 30 atletov iz univerzitetne ekipe Sheffield Hallam University (VB), ki so bili na podlagi vprašalnika o zgodovini poškodb razdeljeni v skupini poškodovani oziroma nepoškodovani. Udeležence raziskave so med njihovim treningom testirali s prilagojenima različicama testov SEBT (3) in BESS (2). Ocenila sta jih neodvisna kvalificirana fizioterapevta. Dobljeni podatki so bili normalizirani glede na dolžino spodnjega uda in analizirani s programom SPSS. **Rezultati:** Rezultati analize niso pokazali na katero izmed značilnih razlik med poškodovanimi in nepoškodovanimi udeleženci tako za skupno vrednost SEBT (87,68 ± 8,1 proti 88,62 ± 8,9 odstotka; p = 0,776) in skupno vrednost BESS (24,1 ± 8,9 proti 21,3 ± 9,7 napake; p = 0,452). Prav tako nadaljnja analiza ni razkrila značilnih razlik med poškodovanim in nepoškodovanim udom znotraj skupine poškodovani. **Sklep:** Rezultati raziskave niso pokazali značilnih razlik med skupinama poškodovani in nepoškodovani pri skupini univerzitetnih atletov z uporabo SEBT in BESS in ne potrjujejo rezultatov iz literature, ki navaja razlike v sposobnosti ohranjanja ravnotežja kot posledice poškodbe. Prihodnje raziskave bi morale natančneje raziskati vpliv določene poškodbe spodnjega uda na kakovost ohranjanja ravnotežja pri vrhunskih atletih.

**Ključne besede**: ravnotežje, ohranjanje drže, poškodba spodnjega uda, SEBT, BESS, atleti.

# How does the lower limb injury affect balance in track and field college athletes

**Background:** Lower limb injury affects postural control of an athlete. For the purpose of quick and easy assessable clinical assessment of balance BESS (Balance Error Scoring System) and SEBT (Star Excursion Balance Test) can be used. Both of the tests have been previously demonstrated as valid and reliable measurement tools for identifying lower limb injuries and participants at risk (1, 3). Track and field (T&F) athletes are likely to sustain lower limb injuries and tend to return to activity with balance deficits (4). Assessing static and dynamic postural control could reveal decreased balance of the injured group and reveal differences between the limbs in the injured group. **Methods:** For the purpose of the study 30 participants were recruited from Sheffield Hallam University T&F team and assigned to the Injured or Non-injured group according to the Questionnaire of Injury of history. Participants performed modified versions of SEBT (3) and BESS (2) test during their training session and were assessed by two independent qualified physiotherapists. The data was normalized to limb length and analysed with SPSS program. **Results:** Results of the analysis have not demonstrated any significant difference between injured and non-injured participants for total SEBT (87.68±8.1 vs. 88.62±8.9%; p=0.776) and total BESS (24.1±8.9 vs. 21.3±9.7 errors; p=0.452). Further analysis also has not showed any significant difference between injured and non-injured limb of the Injured group for both of the tests. **Conclusion:** Though research failed to demonstrate any significant differences between Injured and Non-injured group of college T&F athletes using SEBT and BESS, previous literature demonstrated that postural balance is affected by the injury. Future research should specifically look into effect of specific lower limb injury on postural balance using elite T&F athletes.

**Key words**: balance, postural control, lower limb injury, SEBT, BESS, athletes.

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