

PROCENA RAZLIČITIH TERAPIJSKIH PRISTUPA KINEZITERAPIJE U REDUKCIJI POSTOPERATIVNOG BOLA KOD PACIJENATA SA ARTROPLASTIKOM ZGLOBA KOLENA

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SAŽETAK

Cilj ovog preglednog rada je da se analiziraju različiti terapijski pristupi kineziterapije u smanjenju postoperativnog bola kod pacijenata sa artroplastikom zgloba kolena. Osteoartritis kolena često uzrokuje bol i smanjenu pokretljivost, što se može otkloniti totalnom artroplastikom zgloba kolena. Na osnovu dosadašnjih istraživanja uočava se da preoperativni trening snage poboljšava funkcionalnost i obim pokreta posle jednog i tri meseca od operacije. Neke studije, mada ne sve, pokazuju da nakon rehabilitacije, koja podrazumeva preoperativni trening snage, kod pacijenata sa totalnom artroplastikom zgloba kolena dolazi do smanjenja bola. Takođe, uočava se pojava bola većeg intenziteta devetog dana posle operacije, koji se konstantno smanjuje tokom narednih dana. Intenzitet postoperativnog bola povezan je sa polom, indeksom telesne mase i postojanjem deformiteta kolena. Iako preoperativni trening snage pozitivno utiče na oporavak funkcionalnosti i obima pokreta, njegov efekat na smanjenje postoperativnog bola zahteva dalja istraživanja. Dosadašnja istraživanja ukazuju na potrebu za personalizovanim rehabilitacionim pristupima pacijentima sa totalnom artroplastikom zgloba kolena, uzimajući u obzir složenost bola i različite faktore rizika za nastanak postoperativnog bola. Razvoj personalizovanih protokola rehabilitacije može pružiti znatno bolji oporavak pacijenata nakon urađene totalne artroplastike zgloba kolena u poređenju sa dosadašnjim standardnim pristupima.

Ključne reči: totalna artroplastika zgloba kolena, kineziterapija, postoperativni bol, rehabilitacija

Uvod

Glavna indikacija za totalnu artroplastiku zgloba kolena je osteoartritis kolena jer dovodi do bola i ograničene pokretljivosti, a potom i do invaliditeta (1). Osteoartritis (gonartroza) je degenerativni proces koji se razvija u kolenu kao rezultat nesrazmere između opterećenja i podnošenja opterećenja od strane zglobne hrskavice kolena. Najčešći faktori koji doprinose njegovom nastanku su starenje, gojaznost, nedostatak fizičke aktivnosti, ulazak žene u menopauzu, nasleđe, povrede zgloba kolena, zanimanja koja dodatno opterećuju zglobove kolena i drugo (1-3).

Kod većine pacijenata totalna artroplastika zgloba kolena otklanja bol, poboljšava pokretljivost, a samim tim doprinosi poboljšanju kvaliteta života (1). Ishod totalne artroplastike zgloba kolena zavisi od dobro postavljenih indikacija za operaciju,

dobro obavljene operacije, kao i od pravovremenog i adekvatnog rehabilitacionog tretmana. Ishod artroplastike zgloba kolena može se meriti različitim instrumentima. Jedan od najčešće korišćenih specifičnih upitnika za procenu bola, ukočenosti i funkcije kolena kod osoba sa osteoartritisom je Indeks osteoartritisa univerziteta Zapadni Ontario i McMaster (engl. *The Western Ontario and McMaster Universities Arthritis Index - WOMAC*). To je kratak i jednostavan instrument koji pacijent popunjava 12-15 minuta i koji se sastoji od 24 pitanja koja su podeljena u tri subskele koje procenjuju bol (pet pitanja), ukočenost (dva pitanja) i fizičku funkciju kolena (17 pitanja) (2). Korišćenjem ovog upitnika u većini studija uočava se poboljšanje u pogledu bola i fizičkog funkcionisanja nakon totalne artroplastike zgloba kolena (2). Najveće

ASSESSMENT OF VARIOUS KINESIOTHERAPY TREATMENT APPROACHES IN REDUCING POSTOPERATIVE PAIN IN PATIENTS WITH KNEE JOINT ARTHROPLASTY

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SUMMARY

The aim of this review is to analyze various kinesiotherapy treatment approaches in reducing postoperative pain in patients with knee joint arthroplasty. Knee osteoarthritis often causes pain and reduced mobility, which can be alleviated by total knee joint arthroplasty. Based on previous research, it is observed that preoperative strength training improves functionality and range of motion one to three months after surgery. Some studies indicate that rehabilitation, which includes preoperative strength training, results in decreased pain in patients with total knee joint arthroplasty. Also, some studies suggest an increase in pain intensity 9 days after surgery, which gradually decreases in the following days. Gender, BMI, and knee deformity are associated with higher postoperative pain intensity. Although preoperative strength training has a positive impact on functional recovery and range of motion, its effect on reducing postoperative pain requires further investigation. Previous research highlights the need for personalized rehabilitation approaches for patients undergoing total knee joint arthroplasty, taking into account the complexity of pain and various risk factors for postoperative pain occurrence. The development of personalized rehabilitation protocols may provide significantly better recovery outcomes for patients after total knee joint arthroplasty compared to traditional standard approaches.

Keywords: total knee arthroplasty, kinesiotherapy, postoperative pain, rehabilitation

Introduction

The main indication for total knee arthroplasty is osteoarthritis of the knee because it leads to pain and limited mobility, and consequently to disability (1). Osteoarthritis (gonarthrosis) is a degenerative process that develops in the knee, as a result of a disproportion between the load and load bearing by the knee cartilage. The most common factors that contribute to its appearance are aging, obesity, lack of physical activity, menopause, heredity, injuries of the knee joint, occupations that additionally load the knee joint, etc. (1-3).

In most patients, total knee arthroplasty eliminates pain, improves mobility, and thus contributes to improving the quality of life (1). The outcome of total knee arthroplasty depends on well-established indications for surgery, well-performed surgery, as well as on timely and adequate rehabilitation treatment. The outcome of knee arthroplasty

can be evaluated with different instruments. One of the most frequently used specific questionnaires for assessing knee pain, stiffness and function of the knee in patients with osteoarthritis is The Western Ontario and McMaster Universities Arthritis Index (WOMAC). It is a short and simple instrument, which the patient fills in 12-15 minutes, and it consists of 24 questions that are divided into three subscales that estimate pain (five questions), stiffness (two questions) and physical function of the knee (17 questions) (2). With the help of this questionnaire, the improvement in pain and physical functioning after total knee arthroplasty is observed in most studies (2). The greatest postoperative improvement related to pain and physical functioning is achieved six months after surgery, while additional improvement is achieved one or two years after surgery (2).

postoperativno poboljšanje u pogledu bola i fizičkog funkcionisanja se postiže 6 meseci nakon operacije, dok se manje dodatno poboljšanje postiže posle jedne ili dve godine od operacije (2).

Brojne studije bave se ispitivanjem zadovoljstva pacijenata kod kojih je urađena totalna artroplastika zgloba kolena. Oko 10–20% pacijenata sa urađenom totalnom artroplastikom zgloba kolena je nezadovoljno hirurškim ishodom i prijavljuju uporni postoperativni bol (1). To može dovesti do odložene mobilizacije, dužeg trajanja hospitalizacije, a samim tim i do većih troškova za zdravstveni sistem. Zbog toga je multidisciplinarno lečenje postoperativnog bola od velikog značaja, a to uključuje aktivnosti i saradnju različitih medicinskih stručnjaka kako bi se efikasno upravljalo postoperativnim bolom. Rana rehabilitacija predstavlja poseban izazov za ove pacijente i njihovu reintegraciju (1).

Veoma često mogu nastati postoperativne komplikacije kao što su uporan bol, narušena propriocepcija, poremećena posturalna stabilnost i snaga mišića, a one mogu da traju nekoliko godina, što ima ozbiljan uticaj na postoperativni oporavak pacijenata. Najznačajnija komplikacija nakon totalne artroplastike zgloba kolena je smanjenje mišićne snage. Preoperativna snaga kvadricepsa je bitan faktor u predviđanju funkcije kolena nakon totalne artroplastike zgloba kolena, a snaga mišića je značajno povezana sa bolom, funkcijom kolena, propriocepcijom i funkcijom ravnoteže. Mnoge međunarodne smernice preporučuju trening snage kao osnovnu strategiju lečenja osteoartritisa kolena, a ova terapija je takođe pogodna za pacijente koji čekaju na totalnu artroplastiku zgloba kolena. Preoperativni trening snage ima višestruke pozitivne efekte na rehabilitaciju nakon totalne artroplastike zgloba kolena, odnosno doprinosi smanjenju bola, povećanju mišićne snage i obima pokreta, i boljem funkcionisanju zglobova i oporavku fizičke funkcije (3,4).

Takođe, važan je i program rehabilitacije za poboljšanje postoperativne fizičke funkcije kolena kod pacijenata kod kojih je urađena totalna artroplastika zgloba kolena (5). Program rehabilitacije može da podrazumeva niz fizičkih komponenti, uključujući obnovu obima pokreta (engl. *range of motion* - ROM), jačanje mišića, hodanje, funkcionalne vežbe, vežbe izdržljivosti i ravnoteže.

Cilj ovog preglednog rada je da se analiziraju različiti terapijski pristupi kineziterapije u smanjenju

postoperativnog bola kod pacijenata sa totalnom artroplastikom zgloba kolena.

Metode

U ovom preglednom radu procenjeni su različiti terapijski pristupi kineziterapije u smanjenju postoperativnog bola kod pacijenata sa totalnom artroplastikom zgloba kolena i to na osnovu najnovije literature koja je dobijena pretraživanjem nekoliko relevantnih baza podataka: PubMed, SCIndeks, HRČAK i DOI Serbia.

Pretraživanje literature je realizovano za period 2015-2023. godine korišćenjem sledećih ključnih reči: bol, kineziterapija, artroplastika, zglob kolena i rehabilitacija. Svi radovi su bili na engleskom jeziku.

U okviru ovih istraživanja, korišćeni su različiti instrumenti: Numerička skala ocenjivanja bola (engl. *Numerical Pain Rating Scale* - NRS), Indeks osteoartritisa Univerziteta Zapadni Ontario i McMaster (WOMAC) upitnik, Vizuelna analogna skala bola (VAS) i *Knee Injury and Osteoarthritis Outcome Score* (KOOS). Korišćenjem ovih instrumenata istraživači su merili i ocenjivali intenzitet bola, stepen pokretljivosti i funkcionalnosti pacijenata nakon totalne artroplastike zgloba kolena. Svi radovi odnosili su se na pacijente starosti između 40 i 80 godina.

Redukcija postoperativnog bola kod pacijenata sa totalnom artroplastikom kolena

Sistematski pregled i meta-analiza, autora Wu i saradnika, koja je obuhvatila rezultate sedam randomizovanih kontrolisanih kliničkih studija, je pokazala da preoperativni trening snage dovodi do statistički značajnih poboljšanja u redukciji bola i ukočenosti, kao i u poboljšanju funkcije kolena, funkcionalnoj sposobnosti i fizičkoj funkciji, u poređenju sa kontrolnom grupom koja nije dobijala preoperativni trening snage (3). Nakon totalne artroplastike zgloba kolena, trening snage je pokazao statistički značajno poboljšanje postoperativne funkcije kolena, obima pokreta i funkcionalne sposobnosti nakon jednog i tri meseca, kao i poboljšanje postoperativne snage, redukcije ukočenosti i povećanja WOMAC indeksa nakon 3 meseca, i smanjenje postoperativnog bola nakon 6 meseci (3). Međutim, meta-analiza koja je obuhvatila pet studija je otkrila da preoperativni trening snage nije doprineo značajnom smanjenju postoperativnog bola nakon totalne artroplastike zgloba kolena (3). Međutim, sve ove studije koristile su

Numerous studies examine the satisfaction of patients who have undergone total knee arthroplasty. About 10–20% of patients, who have undergone total knee arthroplasty, are dissatisfied with the surgical outcome and report persistent postoperative pain (1). This can lead to delayed mobilization, longer hospitalization, and therefore, to higher costs for the healthcare system. Therefore, the multidisciplinary treatment of postoperative pain is of great importance, which includes the activities and cooperation of various medical professionals in order to effectively manage the postoperative pain. Early rehabilitation represents a special challenge for these patients and their reintegration (1).

Very often, postoperative complications, such as the persistent pain, impaired proprioception, impaired postural stability and muscular strength, may appear and they can last for several years, and therefore, have a serious impact on the postoperative recovery of patients. The most significant complication after total knee arthroplasty is a decrease in muscular strength. The preoperative strength of quadriceps is an important factor in predicting the knee function after total knee arthroplasty, while muscular strength is significantly associated with pain, function of the knee, proprioception and balance. Many international guidelines recommend strength training as a basic treatment strategy for knee osteoarthritis, and this therapy is also suitable for patients awaiting total knee arthroplasty. Preoperative strength training has multiple positive effects on rehabilitation after total knee arthroplasty, that is, it contributes to reducing pain, improving muscular strength and range of motion, as well as to improving joint functioning and recovery of physical function (3,4).

In addition, the rehabilitation program is also important for improving the postoperative physical function of the knee in patients who have undergone total knee arthroplasty (5). A rehabilitation program may include a number of physical components, including the restoration of range of motion (ROM), improving muscular strength, walking, functional exercises, exercises of endurance and balance.

The aim of this review article is to analyze different therapeutic approaches of kinesitherapy in reducing the postoperative pain in patients with total knee arthroplasty.

Methods

In this review article, different therapeutic approaches of kinesitherapy in reducing the postoperative pain in patients with total knee arthroplasty were evaluated based on the latest literature, which was obtained by searching several relevant databases: PubMed, SCIndex, HRCAC and DOI Serbia.

The literature search was carried out for the period 2015-2023 using the following key words: pain, kinesitherapy, arthroplasty, knee joint and rehabilitation. All papers were in English.

Within this research, the following instruments were used: Numerical Pain Rating scale (NRS), Western Ontario and McMaster University Osteoarthritis Index (WOMAC) questionnaire, Visual Analogue Pain Scale (VAS) and Knee Injury and Osteoarthritis Outcome Score (KOOS). With the help of these instruments, the researchers measured and evaluated the intensity of pain, the degree of mobility and functionality of patients after total knee arthroplasty. All studies were related to patients aged between 40 and 80 years.

The reduction in postoperative pain in patients with total knee arthroplasty

A systematic review and meta-analysis of Wu et al., which included the results of seven randomized controlled clinical studies, showed that preoperative strength training led to the statistically significant improvement in pain and stiffness reduction, as well as in the improvement in knee function, functional ability and physical function, in comparison to the control group that did not receive the preoperative strength training (3). After total knee arthroplasty, strength training showed a statistically significant improvement in postoperative knee function, range of motion and functional capacity one to three months after surgery, as well as the improvement in postoperative strength, reduction in stiffness and increase in WOMAC index after three months, and the reduction in postoperative pain after 6 months (3). However, a meta-analysis, which included five studies, found that preoperative strength training did not contribute to a significant reduction in postoperative pain after total knee arthroplasty (3). However, all these studies used different instruments to measure pain, including the Visual Analogue Scale (VAS), the Copenhagen Osteoarthritis Scale (COS) and the WOMAC questionnaire.

različite instrumente za merenje bola, uključujući VAS, KOOS i WOMAC upitnik.

U meta-analizi autora *Alrawashdeh* i sar, objavljenoj 2021. godine, obuhvaćeni su rezultati šest kliničkih randomizovanih studija, gde su autori koristili VAS za merenje intenziteta bola nakon završetka programa rehabilitacije nakon urađene totalne artroplastike kolena (6). Kontrolna grupa je dobijala standardni program rehabilitacije (uključujući obnovu obima pokreta, jačanje mišića, hodanje) a eksperimentalna grupa pored tog standardnog programa i dodatnu metodu rehabilitacije (progresivna snaga, vežbe sa slingom, neuromuskularna električna stimulacija, vežbe ravnoteže, kontinuirano pasivno kretanje zgloba, vežbe u vodi). Prema numeričkoj vrednosti VAS-a došlo je do nešto veće redukcije postoperativnog bola u eksperimentalnoj grupi, nego među kontrolama, ali razlika nije bila statistički značajna (6).

Međutim, četiri kliničke randomizovane studije (7-10) su prikazale značajno bolje prosečno poboljšanje redukcije postoperativnog bola u eksperimentalnoj grupi (koja je dobijala progresivne vežbe) u poređenju sa kontrolnom grupom (koja je dobijala standardni program koji obuhvata vežbe obima pokreta, vežbe jačanja mišića i vežbe mobilnosti). Ove četiri studije su primenjivale različite pristupe preoperativnom treningu snage. Jedna je koristila progresivnu snagu paralelno sa vežbama obima pokreta (ROM), snage, funkcije i hodanja, druga je koristila vežbe sa slingom, treća je kombinovala vežbe obima pokreta, vežbe snage, funkcije i hodanja sa dodatnim vežbama kao što su transfer i vežbe aktivnosti svakodnevnog života, a četvrta je koristila neuromuskularnu električnu stimulaciju (NMES) uz vežbe snage, ROM-a, funkcije i hodanja.

U istoj meta-analizi (6), objedinjeni su rezultati osam kliničkih randomizovanih studija gde je WOMAC indeks korišćen za procenu postoperativnog bola, ukočenosti i funkcije. Značajno poboljšanje svih parametara je bilo u eksperimentalnoj grupi koji su u programu rehabilitacije imali vežbe snage, ROM, hodanje i vežbe funkcije. Jedna studija je koristila dodatno i vežbe ravnoteže i izdržljivosti i uočila je značajno veće poboljšanje od ostalih studija. Ove studije su potvrdile da je preoperativni trening mišićne snage korisna strategija za poboljšanje funkcionalnosti i oporavka pacijenata koji će biti podvrgnuti totalnoj artroplastici kolena (6).

U studiji autora *Schindler* i sar. (1) uočeno je da se postoperativni bol značajno smanjuje tokom prve nedelje nakon totalne artroplastike zgloba kolena, sa najvećim smanjenjem intenziteta bola osmog dana od operacije. Međutim, nakon perioda od 9 dana, primećen je blag porast intenziteta bola, da bi se zatim konstantno smanjivao tokom narednih dana. Uočeno je da su ženski pol, nizak indeks telesne mase i preoperativni zglobni deformiteti kolena značajno povezani sa većim intenzitetom postoperativnog bola. Ovi nalazi sugerišu potrebu za personalizacijom rehabilitacionog pristupa kako bi se smanjilo nezadovoljstvo pacijenata i prevenirao hroničan bol (1).

Zaključak

Ispitivanjem procene uticaja različitih terapijskih pristupa kineziterapije na redukciju postoperativnog bola pacijenata sa artroplastikom zgloba kolena, dolazimo do zaključka da postoji potencijal za poboljšanje postoperativnog oporavka i funkcionalnosti uz pomoć preoperativnog treninga snage. Iako rezultati ukazuju na značajno poboljšanje postoperativne funkcije kolena, obima pokreta i funkcionalne sposobnosti nakon primene kineziterapije, nalazi u vezi sa smanjenjem postoperativnog bola nisu uniformni.

Neophodna su dalja istraživanja u ovoj oblasti kako bi se razjasnila uloga kineziterapije u smanjenju bola nakon artroplastike zgloba kolena, uz uzimanje u obzir dinamične prirode postoperativnog bola i različitih faktora rizika koji mogu uticati na njegov intenzitet. Ova istraživanja pružaju osnovu za dalji razvoj personalizovanih rehabilitacionih protokola, koji će omogućiti individualizovan pristup svakom pacijentu i doprineti optimalnom postoperativnom ishodu u smislu smanjenja bola i ukupnog funkcionisanja nakon zamene kolena.

Konflikt interesa

Autor je izjavio da nema konflikta interesa.

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A meta-analysis of Alrawashdeh et al., which was published in 2021, included the results of six randomized controlled trials, where the authors used VAS to measure pain intensity after completing the rehabilitation program after total knee arthroplasty (6). The control group received a standard rehabilitation program (including the recovery of range of motion, improving muscular strength, walking), while the experimental group received an additional rehabilitation method apart from the standard program (progressive strength, exercises with the sling, neuromuscular electrical stimulation, balance exercises, continuous passive joint movement, exercises in water). According to the numerical value of VAS, there was a slightly greater reduction in postoperative pain in the experimental group than in the control group, but the difference was not statistically significant (6).

However, four randomized controlled trials (7-10) showed a significantly better average improvement in postoperative pain reduction in the experimental group (which received progressive exercises) in comparison to the control group (which received a standard program which included exercises for the range of motion, exercises for developing muscular strength and mobility exercises). These four studies applied different approaches to preoperative strength training. One used progressive strength in parallel with the exercises of range of motion (ROM), strength, function and walking, while the second used exercises with the sling, the third combined range of motion, strength, function and walking exercises with additional exercises such as transfer exercises and exercises of everyday activities, and the fourth used neuromuscular electrical stimulation (NMES) with exercises of strength, ROM, function and walking (6).

In the same meta-analysis (6), the results of eight randomized controlled trials, where the WOMAC index was used to assess the postoperative pain, stiffness and function, were collected. A significant improvement in all parameters was in the experimental group that had strength exercises, ROM, walking and function exercises in the rehabilitation program. One study additionally used balance and endurance exercises, and a significantly greater improvement was found in this study in comparison to other studies. These studies have confirmed that preoperative strength training is a useful strategy to improve the functionality and recovery of patients who will undergo total knee arthroplasty (6).

In the study of Schindler et al. (1), it was noticed that the postoperative pain significantly decreased during the first week after total knee arthroplasty, with the greatest decrease in pain intensity on the eighth day after surgery. However, after the period of 9 days, a slight increase in pain intensity was observed, and it decreased constantly during the following days. It was observed that the female gender, low body mass index and preoperative knee joint deformities were associated with the higher intensity of postoperative pain. These findings suggest the need for a personalized rehabilitation approach in order to reduce patients' dissatisfaction and prevent chronic pain (1).

Conclusion

By examining the assessment of the impact of different therapeutic approaches of kinesitherapy on the reduction in postoperative pain in patients with knee arthroplasty, the conclusion is reached that there is potential for improving the postoperative recovery and functionality with the help of preoperative strength training. Although the results point to a significant improvement in postoperative knee function, range of motion and functional ability after the application of kinesitherapy, findings related to the postoperative pain reduction are not uniform.

Further research in this field is necessary in order to clarify the role of kinesitherapy in reducing pain after knee arthroplasty, taking into consideration the dynamic nature of postoperative pain and different risk factors that may influence its intensity. These studies provide the basis for further development of personalized rehabilitation protocols, which will enable an individualized approach to each patient and contribute to the optimal postoperative outcome in terms of pain reduction and overall functioning after knee replacement.

Competing interests

The author declared no competing interests.

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