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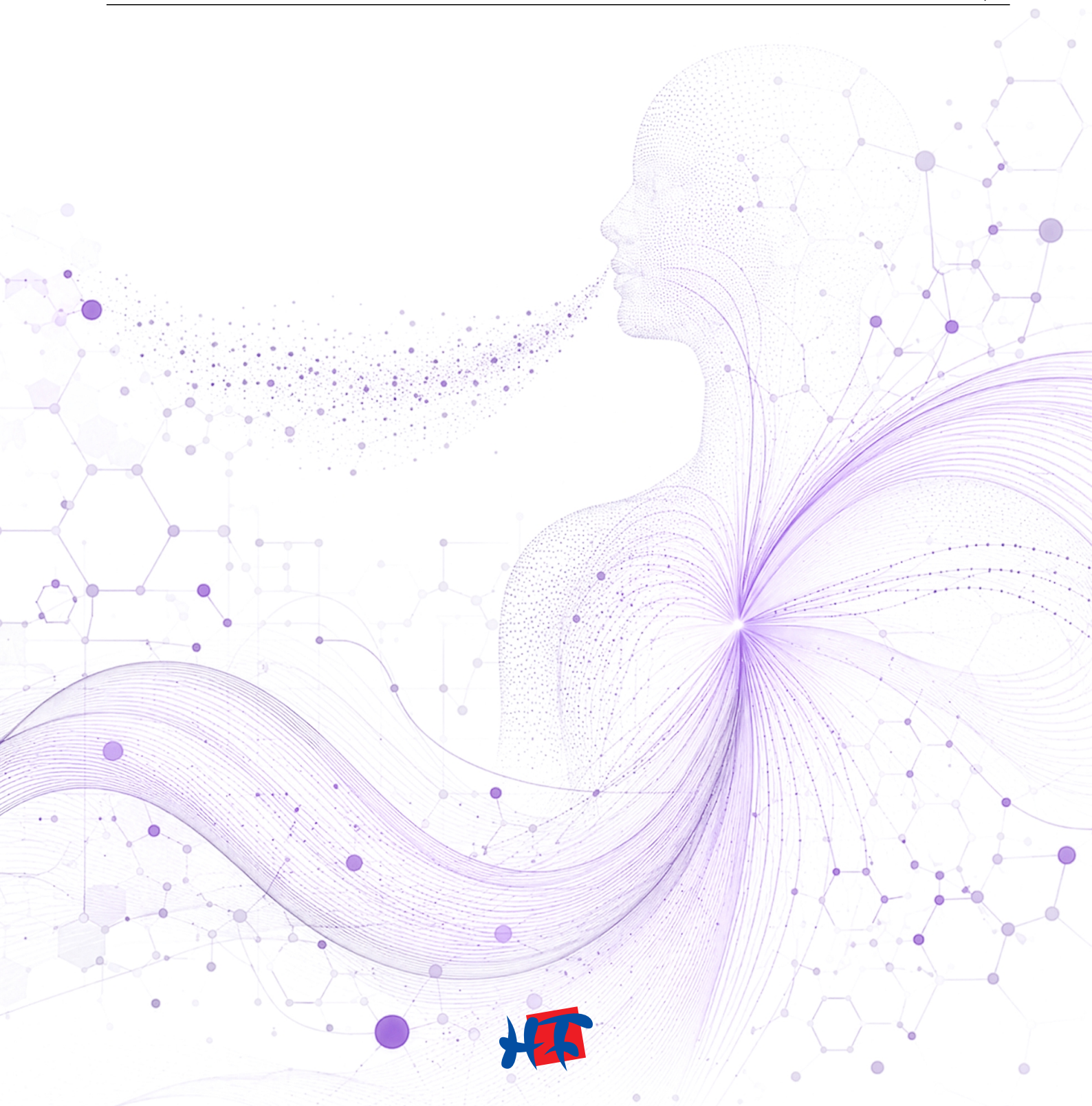
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SADRŽAJ

NEUROMIŠIĆNA REEDUKACIJA POKRETA LICA PRIMJENOM5	
sEMG BIOFEEDBACKA U REHABILITACIJI TEŠKE BELLOVE KLJENUTI	
Neuromuscular re-education of facial motor function using surface electromyography (sEMG) biofeedback in the rehabilitation of severe Bell's palsy	
DUNJA LAPOV	
TERAPIJA POKRETOM NISKOG INTENZITETA12	
Low-intensity movement therapy	
ANTUN JURINIĆ, ALDA RANOGAJEC	
PROCJENA RAZINE TJELESNE AKTIVNOSTI PRIMJENOM MEĐUNARODNOG 17	
UPITNIKA O TJELESNOJ AKTIVNOSTI (IPAQ): PRESJEČNO ISTRAŽIVANJE	
Assessment of physical activity levels using the international physical activity questionnaire (IPAQ): a cross-sectional study	
ANTONELLA RUPČIĆ, IVANA KLARIĆ-KUKUZ	
EXPLORING SEASONAL AND ORGANISATIONAL DETERMINANTS OF INJURY27	
RECURRENCE AND BURDEN IN CROATIAN FOOTBALL AND HANDBALL	
Utjecaj sezonskih i organizacijskih čimbenika na ponavljanje ozljeda i opterećenje ozljedama u hrvatskom nogometu i rukometu	
ELVIR GOSIĆ, SANDRO UGRINA	
EVALUATION OF RECOVERY FACTORS IN INDIVIDUALS35	
WITH CHRONIC LOW BACK PAIN	
Procjena čimbenika oporavka u osoba s kroničnom križoboljom	
MARKO BODROŽIĆ, ANA PILJIĆ	
COGNITIVE-MOTOR EXERGAMING TRAINING IN AN OLDER46	
PATIENT WITH DEPRESSION AND PSYCHOTIC SYMPTOMS	
Kognitivno-motorički exergaming trening kod starije pacijentice s depresijom i psihotičnim simptomima	
MAJA TKALIČANAC	
FACILITACIJOM DO AKTIVNOG POKRETA51	
Facilitation towards active movement	
SANJICA VLAŠIĆ, MARINA BRIZIĆ	
PROPRIOCEPTIVNA NEUROMUSKULARNA FACILITACIJA U REHABILITACIJI58	
PACIJENTICE S PROTRUZIJOM INTERVERTEBRALNIH DISKOVA	
Proprioceptive neuromuscular facilitation in the rehabilitation of a patient with intervertebral disc protrusions	
MARINA BRIZIĆ	
PULMONARY REHABILITATION AFTER IVOR LEWIS ESOPHAGECTOMY64	
FOR END-STAGE ACHALASIA	
Plućna rehabilitacija nakon Ivor Lewis ezofagektomije u bolesnice s krajnjim stadijem ahalazije	
SNJEŽANA BENKO MEŠTROVIĆ, MARTIN IVANOVIĆ, MARIJA GOMERČIĆ PALČIĆ, ALDA RANOGAJEC, ANTEA MARKOVIĆ	

NEUROMIŠIĆNA REEDUKACIJA POKRETA LICA PRIMJENOM sEMG BIOFEEDBACKA U REHABILITACIJI TEŠKE BELLOVE KLJENUTI

Neuromuscular re-education of facial motor function using surface electromyography (sEMG) biofeedback in the rehabilitation of severe Bell's palsy

DUNJA LAPOV¹

<https://doi.org/10.64542/pc1.20.1>

SAŽETAK

Uvod: Bellova kljenut akutna je idiopatska periferna neuropatija facijalnog živca koja uzrokuje poremećaj pokreta mimičke muskulature te može dovesti do značajnih funkcionalnih, estetskih i psihosocijalnih posljedica. U rehabilitaciji bolesnika s težim kliničkim oblicima sve se češće primjenjuju tehnike neuromišićne reedukacije, među kojima je i površinska elektromiografija uz biofeedback (sEMG biofeedback), iako su dokazi o njezinoj učinkovitosti još uvijek ograničeni. Cilj ovog rada bio je prikazati primjenu sEMG biofeedbacka u rehabilitaciji bolesnika s teškom Bellovom kljenuti te opisati klinički tijek i funkcionalni ishod rehabilitacije.

Prikaz slučaja: Prikazan je slučaj 82-godišnjeg bolesnika s teškom Bellovom kljenuti (House-Brackmann stupanj V), koja je perzistirala unatoč liječenju sistemskim kortikosteroidima i početnom ciklusu sEMG biofeedbacka. Zbog izostanka očekivanog oporavka nastavljen je individualizirani fizioterapijski program koji je uključivao sEMG biofeedback, edukaciju o zaštiti oka, kinesiotaping, samomasažu, primjenu toplih obloga te postupno uvođenje kućnog programa vježbi pred ogledalom. Tijekom sedmomjesečne rehabilitacije provedeno je ukupno 70 tretmana sEMG biofeedbacka pod neposrednim nadzorom fizioterapeuta.

Rezultati: Po završetku rehabilitacije postignut je oporavak do House-Brackmannova stupnja II, uz simetriju lica u mirovanju, potpuno zatvaranje oka, nestanak funkcionalnih poteškoća pri žvakanju i govoru te blagu sinkineziju pri maksimalnom zatvaranju oka. Zaostao je izostanak spontanog treptanja pri umoru, s posljedičnim isušivanjem oka i povremenim refleksnim suzenjem, zbog čega je prema preporuci oftalmologa u daljnjem tijeku liječenja moguće razmotriti ugradnju utega u gornju vjeđu.

Zaključak: Prikazani slučaj upućuje na moguću korist individualiziranog fizioterapijskog programa temeljenog na sEMG biofeedbacku, uz naglasak na selektivnu neuromišićnu reedukaciju i selektivnu kontrolu mimičkih pokreta, u bolesnika s teškom Bellovom kljenuti i odgođenim oporavkom. Potrebna su daljnja prospektivna istraživanja radi utvrđivanja učinkovitosti ovakvog pristupa i razvoja standardiziranih rehabilitacijskih protokola.

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Ključne riječi: Bellova kljenut; sEMG biofeedback; neuromišićna reedukacija; selektivna kontrola pokreta.

ABSTRACT

Introduction: Bell's palsy is an acute idiopathic peripheral neuropathy of the facial nerve that impairs facial muscle movement and may result in significant functional, aesthetic, and psychosocial consequences. In patients with more severe clinical presentations, neuromuscular re-education techniques, including surface electromyography biofeedback (sEMG biofeedback), are increasingly used in rehabilitation despite the limited evidence regarding their effectiveness. The aim of this study was to present the application of sEMG biofeedback in the rehabilitation of a patient with severe Bell's palsy and to describe the clinical course and functional outcome of rehabilitation.

Case presentation: We present the case of an 82-year-old patient with severe Bell's palsy (House–Brackmann grade V) that persisted despite treatment with systemic corticosteroids and an initial course of sEMG biofeedback therapy. Owing to the lack of the expected recovery, an individualized physiotherapy program was continued, including sEMG biofeedback, education on eye protection, kinesiotaping, self-massage, warm compresses, and the gradual introduction of a home-based mirror exercise program. During the seven-month rehabilitation period, the patient underwent a total of 70 sEMG biofeedback sessions under the direct supervision of a physiotherapist.

Results: At the completion of rehabilitation, recovery to House–Brackmann grade II was achieved, with restoration of facial symmetry at rest, complete eye closure, resolution of chewing and speech difficulties, and only mild synkinesis during maximal eye closure. Persistent absence of spontaneous blinking during fatigue, accompanied by ocular dryness and occasional reflex tearing, remained; therefore, implantation of an upper eyelid weight was considered as a possible future treatment option following the ophthalmologist's recommendation.

Conclusion: This case suggests that an individualized physiotherapy program based on sEMG biofeedback, with emphasis on selective neuromuscular re-education and selective control of facial movements, may be beneficial in patients with severe Bell's palsy and delayed recovery. Further prospective studies are needed to determine the effectiveness of this approach and to develop standardized rehabilitation protocols.

Keywords: Bell's palsy; sEMG biofeedback; neuromuscular re-education; selective motor control.



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UVOD

Ljudsko lice ima ključnu ulogu u izražavanju emocija, neverbalnoj komunikaciji i socijalnim interakcijama te predstavlja važan dio osobnog identiteta i kvalitete života (1).

Bellova kljenut (engl. *Bell's palsy*) akutna je idiopatska periferna neuropatija facijalnog živca (VII. moždanog živca) koja se klinički očituje iznenadnom jednostranom slabošću mimičke muskulature različitog stupnja, od blage pareze do potpune paralize. Klinička slika može biti praćena utrnuošću, blagom boli, pojačanom osjetljivošću na zvuk i promjenom osjeta okusa. Predstavlja najčešći uzrok periferne disfunkcije facijalnog živca te najčešću mononeuropatiju kranijalnih živaca. Procjenjuje se da čini 60–75 % svih slučajeva periferne

disfunkcije facijalnog živca, uz godišnju incidenciju od 7–40 slučajeva na 100 000 stanovnika. Bolest podjednako zahvaća muškarce i žene te se može javiti u bilo kojoj životnoj dobi, iako incidencija raste s dobi. Povećan rizik za razvoj Bellove kljenuti imaju osobe sa šećernom bolešću, arterijskom hipertenzijom, pretilošću, trudnice te osobe s infekcijama gornjih dišnih putova (2). Unatoč brojnim istraživanjima, etiologija bolesti još uvijek nije u potpunosti razjašnjena. Smatra se da u njezinu nastanku sudjeluju međusobno povezani virusni, imunološki i ishemijski mehanizmi (3). Pretpostavlja se da u podlozi bolesti dolazi do razvoja edema facijalnog živca, što dovodi do njegove kompresije i poremećaja provođenja živčanih impulsa. Budući da se u većine bolesnika

specifičan uzrok ne može utvrditi, dijagnoza Bellove kljenuti postavlja se isključivanjem drugih mogućih uzroka oštećenja facijalnog živca. Klinička slika očituje se naglo nastalom jednostranom perifernom slabošću ili paralizom mimičke muskulature koja doseže puni intenzitet unutar 48 sati (2). Karakteristično je zahvaćanje gornjeg i donjeg dijela iste strane lica. U gornjem dijelu lica prisutna je smanjena ili odsutna mogućnost nabiranja čela, nepotpuno zatvaranje oka te smanjena pokretljivost obrve. U donjem dijelu lica uočavaju se spušten usni kut, izravnane nazolabijalne brazde te otežano ili onemogućeno napuhivanje obraza i izvođenje pokreta usana (4). U kliničkoj se praksi za procjenu stupnja oštećenja funkcije facijalnog živca najčešće primjenjuje House-Brackmannova ljestvica, koja omogućuje standardiziranu procjenu težine kliničke slike i praćenje oporavka tijekom rehabilitacije (5). Klinička procjena uključuje detaljnu anamnezu, fizikalni pregled te diferencijalno dijagnostičku obradu radi potvrđivanja periferne prirode oštećenja i isključivanja drugih mogućih uzroka slabosti facijalnog živca. Utvrđeno je da rano liječenje kortikosteroidima poboljšava oporavak funkcije lica, osobito ako se započne unutar prvih 72 sata od početka simptoma (6). Većina bolesnika pokazuje prve znakove spontanog oporavka unutar prva tri tjedna od početka bolesti, a potpuni spontani oporavak postiže se u 66–85 % bolesnika. Međutim, u bolesnika s težim početnim kliničkim oblikom češće zaostaju trajna slabost mimičke muskulature, sinkinezije te funkcionalne, estetske i psihološke posljedice koje mogu značajno narušiti kvalitetu života (7).

Ovisno o težini kliničke slike, uz medikamentozno liječenje primjenjuju se fizioterapijske intervencije usmjerene na poboljšanje neuromuskularne kontrole, prevenciju komplikacija i poticanje funkcionalnog oporavka. Među suvremenim rehabilitacijskim pristupima sve se više primjenjuje biofeedback temeljen na površinskoj elektromiografiji (sEMG biofeedback), neinvazivna metoda koja registrira bioelektričnu aktivnost mišića i prikazuje je u stvarnom vremenu putem vizualne ili auditivne povratne informacije. Time bolesniku omogućuje svjesnu kontrolu i ponovno učenje selektivne aktivacije oslabljene mimičke muskulature, čime se poboljšavaju neuromuskularna kontrola i koordinacija pokreta lica (8). Dosadašnja istraživanja upućuju na moguću korist sEMG biofeedbacka u poboljšanju simetrije lica i smanjenju sinkinezija, no sustavni pregled Khana i suradnika pokazao je da su dostupni dokazi i dalje ograničeni zbog malog broja visokokvalitetnih istraživanja i heterogenosti rehabilitacijskih protokola (9). Cilj ovog rada je prikazati primjenu površinske elektromiografije (sEMG) biofeedbacka u rehabilitaciji bolesnika s teškom Bellovom kljenuti s teškim komorbiditetima te opisati klinički tijek i funkcionalni ishod individualiziranog fizioterapijskog programa.

PRIKAZ SLUČAJA

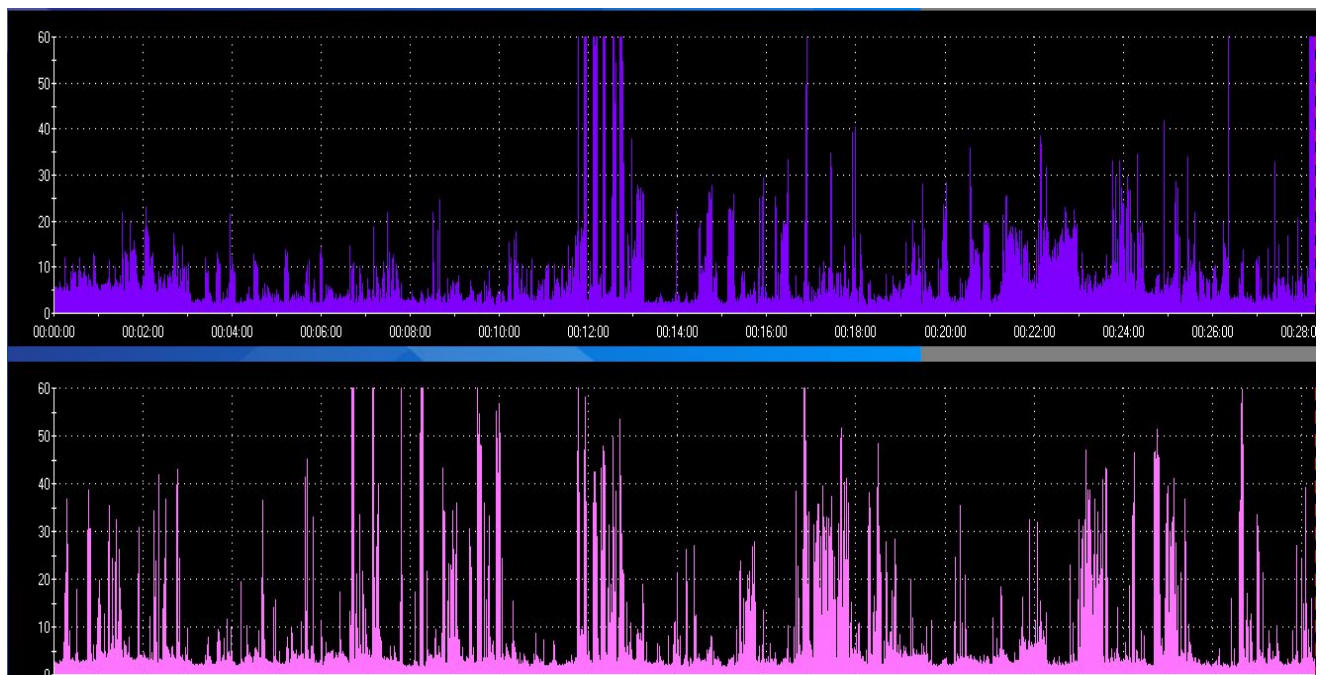
Bolesnik u dobi od 82 godine javio se u hitni medicinski prijem tijekom kolovoza zbog akutno nastale periferne pareze desnog facijalnog živca. Tegobe su se pojavile tijekom toplinskog vala, nakon višesatnog putovanja automobilom uz dugotrajnu izloženost klimatizaciji. Bolesnik navodi da je noć nakon putovanja protekla bez tegoba. Sljedećeg jutra uočio je nemogućnost potpunog zatvaranja desnog oka te spuštenost desne obrve i desnog usnog kuta, uz mlohavost cijele desne polovice lica. Kliničkim pregledom potvrđena je izražena slabost mimičke muskulature desne polovice lica. Nakon provedene dijagnostičke obrade postavljena je dijagnoza periferne pareze desnog facijalnog živca (*paresis nervi facialis dextri peripherica*), započeto je liječenje sistemskim kortikosteroidima prema standardnom terapijskom protokolu.

U osobnoj anamnezi zabilježeni su značajni komorbiditeti, uključujući stanje nakon transplantacije jetre uz imunosupresivnu terapiju, fibrilaciju atrija i kroničnu bubrežnu bolest II. stupnja.

Dva tjedna nakon postavljanja dijagnoze bolesnik je započeo fizioterapiju primjenom sEMG biofeedbacka te završio prvi ciklus od 10 tretmana, nakon kojeg nije zabilježeno klinički značajno poboljšanje. Zbog izostanka očekivanog oporavka, dva mjeseca nakon postavljanja dijagnoze započeo je drugi, prošireni ciklus fizioterapije koji je, uz sEMG biofeedback, uključivao i dodatne fizioterapijske intervencije.

Prije uključivanja u drugi ciklus fizioterapije kliničkim pregledom fizijatra utvrđena je teška periferna pareza desnog facijalnog živca, gradirana prema House-Brackmannovoj ljestvici kao stupanj V, uz minimalnu voljnu aktivaciju mimičke muskulature čela i usnog kuta, nemogućnost potpunog zatvaranja desnog oka (interpalpebralni razmak 5 mm), lagoftalmus, paralitički ektropij donje desne vjeđe te izraženu atrofiju mimičke muskulature desne polovice lica.

Tijekom fizioterapijske procjene bolesnik je navodio izražene funkcionalne poteškoće, uključujući zadržavanje hrane između obraza i zuba na zahvaćenoj strani tijekom žvakanja, suhoću desnog oka te otežanu artikulaciju govora, dok promjene osjeta okusa nije zamjećivao. Također je uočeno da bolesnik pri uklanjanju zaštitne očne komorice, indicirane od strane oftalmologa, povlači donju vjeđu prema dolje. S obzirom na izraženu atrofiju mimičke muskulature procijenjeno je da takav način uklanjanja komorice može dodatno pogoršati položaj donje vjeđe i pridonijeti progresiji paralitičkog ektropija. Površinska elektromiografija (sEMG) tijekom izvođenja mimičkih pokreta – podizanja obrva, mrštenja, facilitiranog zatvaranja oka, pokreta poljupca, forsiranog osmijeha i napuhivanja obraza – zabilježila je tek minimalnu voljnu aktivaciju zahvaćene mimičke muskulature.



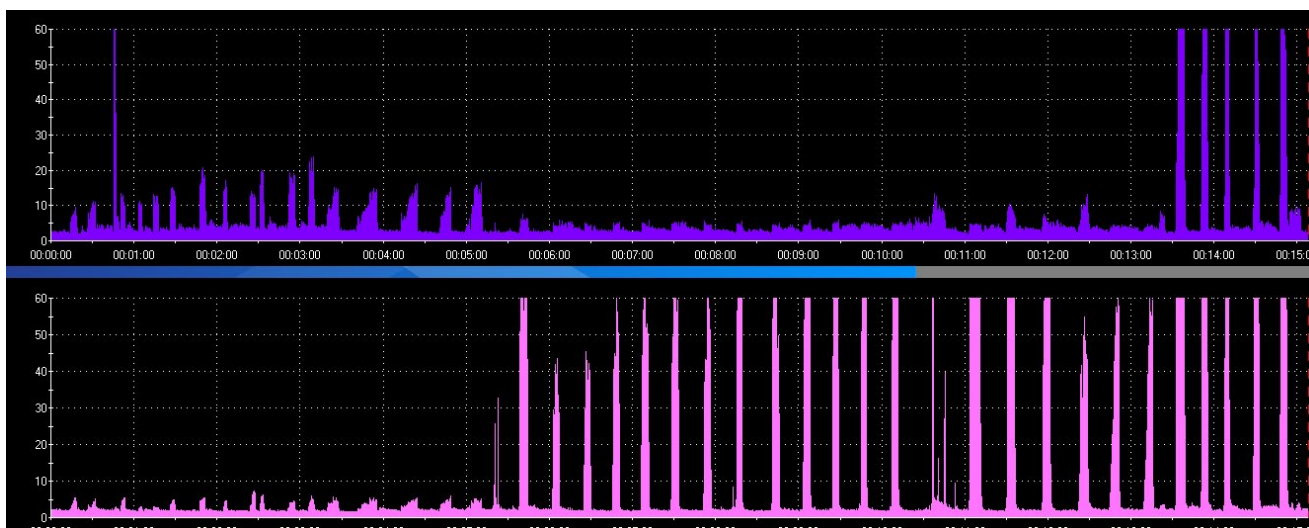
Slika 1. Početna foto dokumentacija (A) sEMG trening s prikazom neselektivne aktivacije mišićne mskulature tijekom izvođenja ciljanih pokreta. (B) Početna klinička fotografija bolesnika s prikazom položaja površinskih elektroda za sEMG biofeedback.

Nakon provedene fizioterapijske procjene započet je individualizirani fizioterapijski program koji je uključivao edukaciju o pravilnom uklanjanju zaštitne očne komorice indicirane od strane oftalmologa, sEMG biofeedback te povremenu primjenu kinesiotapinga. Kao početni dio kućnog programa bolesniku su preporučeni samomasaža i primjena toplih obloga, uz nastavak provođenja mjera zaštite oka prema preporuci oftalmologa.

sEMG biofeedbackom praćena je funkcionalna aktivnost mišićne mskulature gornje i donje regije lica. Jedan par površinskih elektroda postavljen je u frontalnu i periorbitalnu regiju, a drugi par u perioralnu regiju, čime je omogućeno odvojeno praćenje aktivnosti funkcionalnih mišićnih skupina tijekom izvođenja mišićnih pokreta. Svaki tretman započinjao je relaksacijom gornje i donje polovice lica do razine bazalne mišićne aktivnosti ($< 5 \mu V$), što odgovara mišićnom mirovanju. Nakon toga slijedio je trening selektivne kontrole mišićnih pokreta gornje polovice lica (podizanje obrva, mrštenje i facilitirano zatvaranje oka) te donje polovice lica (pokret poljupca, napuhivanje obraza i zaobljivanje usana pri izgovoru glasa „o“). Forsirani osmijeh bio je jedini složeni mišićni pokret uključen u rehabilitacijski program jer zahtijeva koordiniranu aktivaciju mišićne mskulature gornje i donje regije lica, dok su se ostali složeni pokreti izbjegavali radi smanjenja rizika od razvoja sinkinezija i kompenzacijskih obrazaca aktivacije.

Ciljevi fizioterapijskih intervencija bili su uspostava selektivne kontrole mišićnih pokreta, smanjenje kompenzacijske hiperaktivacije mišićne mskulature nezahvaćene strane lica, prevencija razvoja sinkinezija, poboljšanje simetrije lica, edukacija bolesnika za pravilno provođenje kućnog programa te pravilno rukovanje zaštitnom očnom komoricom uz provođenje mjera zaštite oka prema preporuci oftalmologa.

S obzirom na težinu početnog funkcionalnog deficita i minimalnu voljnu aktivaciju zahvaćene mišićne mskulature, u početnoj fazi drugog ciklusa fizioterapije bolesnik je bio uključen u sEMG biofeedback trening pet puta tjedno, ukupno 30 tretmana. Pri pokušajima izvođenja voljnih mišićnih pokreta uočena je izražena kompenzacijska hiperaktivacija mišićne mskulature nezahvaćene strane lica, koja je dodatno naglašavala facijalnu asimetriju.



Slika 2. Završna foto dokumentacija po završetku fizioterapije. (A) Završni sEMG trening koji prikazuje selektivnu i izoliranu aktivaciju mimičke muskulature tijekom izvođenja ciljanih mimičkih pokreta gornje i donje regije lica (podizanje obrva, mrštenje, zatvaranje oka, pokret poljupca, napuhivanje obraza i forsirani osmijeh). (B) Završna klinička fotografija bolesnika s postignutom simetrijom lica u mirovanju i uspostavljenom funkcionalnom kontrolom mimičke muskulature. Pri maksimalnom zatvaranju oka prisutna je blaga sinkinezija s koaktivacijom usnog kuta.

Zbog nemogućnosti uspostave pouzdane selektivne kontrole mimičkih pokreta i visokog rizika razvoja neadekvatnih motoričkih obrazaca u ovoj fazi nisu preporučene samostalne aktivne vježbe lica pred ogledalom u kućnim uvjetima.

Naglasak rehabilitacije nije bio na povećanju broja ponavljanja mimičkih pokreta, nego na uspostavi njihove kontrolirane i selektivne izvedbe uz kontinuirano vođenje fizioterapeuta i vizualnu povratnu informaciju putem

sEMG biofeedbacka. U kućnim uvjetima preporučeni su primjena toplih obloga i samomasaža radi održavanja elastičnosti i pokretljivosti mekih tkiva, poticanja lokalne mikrocirkulacije te smanjenja rizika od razvoja sekundarnih mekotkivnih promjena. Kinesiotaping je primjenjivan jednom tjedno, neposredno prije dvodnevne stanke između fizioterapijskih tretmana, s ciljem održavanja funkcionalne potpore zahvaćenoj mimičkoj muskulaturi tijekom razdoblja bez nadziranih intervencija.

Prvih 30 tretmana provedeno je pet puta tjedno, sljedećih 30 tri puta tjedno, a završnih 10 dva puta tjedno. Nakon smanjenja učestalosti fizioterapijskih tretmana na tri puta tjedno bolesnik je u dane bez nadziranih fizioterapijskih tretmana započeo samostalno provoditi program vježbi pred ogledalom prema prethodno usvojenim uputama. Tijekom sedmomjesečne rehabilitacije provedeno je ukupno 70 tretmana sEMG biofeedbacka, pri čemu su svi tretmani provedeni pod neposrednim nadzorom fizioterapeuta, uz kontinuirano multidisciplinarno praćenje fizijatra i oftalmologa. Završna foto dokumentacija i sEMG zapis prikazani su na slici 2.

Na završnom kontrolnom pregledu fizijatra utvrđeno je potpuno zatvaranje desnog oka uz oslabljen stisak vjeđa. Pri maksimalnom stisku oka bila je prisutna blaga sinkinezija s koaktivacijom usnog kuta, dok je u mirovanju postignuta simetrija lica. Bolesnik je navodio da pri umoru izostaje spontano treptanje, što dovodi do isušivanja oka i povremenih epizoda refleksnog suzenja. Više nije navodio poteškoće pri žvakanju niti otežanu artikulaciju govora. Ciljane vježbe za lice više nisu preporučene jer je za održavanje postignutog funkcionalnog oporavka bila dovoljna spontana mimika. Prema mišljenju oftalmologa, u daljnjem tijeku liječenja može se razmotriti ugradnja utega u gornju vjeđu.

Po završetku rehabilitacije klinički nalaz odgovarao je House-Brackmannovu stupnju II, uz postignutu simetriju lica u mirovanju, potpuno zatvaranje oka uz oslabljen stisak vjeđa te blagu sinkineziju pri maksimalnom stisku oka.

RASPRAVA

U ovom prikazu slučaja opisan je oporavak bolesnika s teškom perifernom parezom facijalnog živca (House-Brackmann stupanj V) liječenog individualiziranim fizioterapijskim programom koji je uključivao edukaciju, sEMG biofeedback, kinesiotaping, kućni program samomasaže i primjene toplih obloga te postupno uvođenje aktivnih vježbi lica pred ogledalom nakon uspostave zadovoljavajuće selektivne kontrole mimičkih pokreta. Nakon sedmomjesečne rehabilitacije, tijekom koje je provedeno ukupno 70 tretmana sEMG biofeedbacka pod neposrednim nadzorom fizioterapeuta, postignut je oporavak do House-Brackmannova stupnja II, uz uspostavu simetrije lica u mirovanju, potpuno zatvaranje oka te nestanak funkcionalnih poteškoća pri žvakanju i govoru. Iako je pri maksimalnom stisku oka zaostala blaga sinkinezija, ukupni funkcionalni ishod bio je klinički povoljan.

Fizioterapija danas predstavlja važan dio liječenja bolesnika s Bellovom kljenuti, osobito kod težih oblika bolesti ili nepotpunog spontanog oporavka. Sustavni pregled Khana i suradnika pokazao je da terapijske vježbe lica mogu poboljšati funkcionalni oporavak i smanjiti razvoj sinkinezija, pri čemu se najbolji rezultati postižu kada se rehabilitacija provodi individualizirano i pod nadzorom educiranog terapeuta. Istodobno autori ističu veliku heterogenost rehabilitacijskih protokola te nedostatak visokokvalitetnih istraživanja koja bi omogućila izradu standardiziranih smjernica za fizioterapijsku rehabilitaciju (9).

Slične zaključke donosi i međunarodni konsenzus stručnjaka za rehabilitaciju odraslih bolesnika s unilateralnom parezom facijalnog živca, koji naglašava važnost standardizirane procjene, individualiziranog terapijskog pristupa, edukacije bolesnika i postupnog razvoja kućnog programa. Konsenzus ističe selektivnu neuromišićnu reedukaciju kao temelj rehabilitacije te ne preporučuje rutinsku primjenu pojedinih tradicionalnih terapijskih modaliteta (10). U skladu s tim preporukama rehabilitacija u ovom prikazu slučaja nije bila usmjerena na velik broj ponavljanja mimičkih pokreta, nego na njihovu kontroliranu i selektivnu izvedbu uz kontinuirano vođenje fizioterapeuta i vizualnu povratnu informaciju putem sEMG biofeedbacka. Samostalni program vježbi pred ogledalom uveden je tek nakon što je postignuta zadovoljavajuća selektivna kontrola mimičkih pokreta i smanjena kompenzacijska aktivacija nezahvaćene strane lica, čime se nastojalo spriječiti razvoj nepravilnih motoričkih obrazaca i sinkinezija.

Posebna vrijednost ovog prikaza slučaja jest detaljan opis rehabilitacijskog protokola. U većini objavljenih istraživanja sEMG biofeedback navodi se kao jedna od primijenjenih metoda, dok su položaj elektroda, odabir pojedinih mimičkih pokreta, kriteriji za napredovanje

terapije, intenzitet i učestalost tretmana te odluke o uvođenju kućnog programa rijetko detaljno opisani. U ovom radu prikazani su upravo ti elementi kliničkog odlučivanja, uključujući odgodu samostalnih vježbi lica pred ogledalom do uspostave zadovoljavajuće selektivne kontrole pokreta, što može pridonijeti boljoj standardizaciji rehabilitacijskih postupaka i njihovoj primjeni u svakodnevnoj kliničkoj praksi.

Važan dio rehabilitacije predstavljala je kontinuirana edukacija bolesnika, koja se prema međunarodnom konsenzusu smatra jednim od ključnih elemenata suvremene rehabilitacije bolesnika s unilateralnom parezom facijalnog živca (10). Tijekom fizioterapijske procjene uočeno je nepravilno uklanjanje zaštitne očne komorice povlačenjem donje vjeđe prema dolje, što je moglo dodatno pogoršati paralitički ektropij. Pravodobnom edukacijom o pravilnom rukovanju zaštitnom očnom komoricom, provođenju mjera zaštite oka prema preporuci oftalmologa te postupnom uvođenju kućnog programa nastojalo se smanjiti rizik od sekundarnih komplikacija i razvoja neadekvatnih motoričkih obrazaca. Ovakav multidisciplinarni pristup, uz suradnju fizioterapeuta, fizijatra i oftalmologa, predstavlja važan dio suvremene rehabilitacije bolesnika s Bellovom kljenuti.

Ograničenje ovog rada proizlazi iz činjenice da je riječ o prikazu jednog bolesnika, zbog čega nije moguće donositi zaključke o učinkovitosti pojedinih fizioterapijskih intervencija niti izdvojiti doprinos svake od njih konačnom ishodu liječenja. Međutim, detaljno prikazan rehabilitacijski protokol, jasno opisani kriteriji kliničkog odlučivanja te sustavno praćenje bolesnika tijekom sedmomjesečne rehabilitacije predstavljaju vrijedan doprinos dostupnoj literaturi i mogu poslužiti kao podloga za buduća prospektivna istraživanja učinkovitosti sEMG biofeedbacka u rehabilitaciji Bellove pareze.

ZAKLJUČAK

Pareza ili paraliza facijalnog živca može značajno narušiti facijalnu funkciju i kvalitetu života bolesnika te imati važne psihološke i socijalne posljedice. Budući da se u većine bolesnika s Bellovom kljenuti očekuje spontani oporavak, intenzivna fizioterapijska rehabilitacija nije indicirana u svim slučajevima. Međutim, kod bolesnika s teškom parezom, odgođenim oporavkom ili visokim rizikom razvoja trajnih posljedica, individualizirani rehabilitacijski program može predstavljati važan dio liječenja.

U prikazanom slučaju individualizirani fizioterapijski program, utemeljen na selektivnoj neuromišićnoj reedukaciji uz primjenu sEMG biofeedbacka, kinesiotapinga, edukacije i strukturiranog kućnog programa, bio je povezan sa značajnim poboljšanjem facijalne funkcije,

simetrije lica i svakodnevnog funkcioniranja bolesnika. Ovaj prikaz slučaja upućuje na moguću korist takvog pristupa u bolesnika s teškom Bellovom kljenuti i odgođenim oporavkom, no zbog prirode prikaza jednog slučaja nije moguće donositi zaključke o njegovoj učinkovitosti.

Potrebna su daljnja prospektivna istraživanja na većem broju bolesnika kako bi se utvrdila učinkovitost sEMG biofeedbacka i drugih fizioterapijskih intervencija te razvili standardizirani rehabilitacijski protokoli i standardizirani postupci procjene i praćenja ishoda rehabilitacije bolesnika s Bellovom kljenuti.

Izjava o informiranom pristanku: Bolesnik je dao pisani informirani pristanak za objavu ovog prikaza slučaja i kliničkih fotografija koje prate rukopis.

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TERAPIJA POKRETOM NISKOG INTENZITETA

Low-intensity movement therapy

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SAŽETAK

Uvod: Terapija pokretom predstavlja jednu od najstarijih metoda fizioterapije koja prema nekim zapisima postoji već više od 6000 godina. Neizostavna je u rehabilitaciji bolesnih, nakon ozljeda ili operacija. Cilj ovog rada bio je prikupiti jasne znanstvene dokaze o učincima terapije pokretom niskog intenziteta na bol, mišićnu snagu, ravnotežu, opću pokretljivost, kardiovaskularnu funkciju i psihološko zdravlje te kvalitetu života i sigurnost pacijenta.

Metode: Proveden je pregled literature pretraživanjem relevantnih baza podataka PubMed, MEDLINE, Cochrane, SCOPUS, Hrčak. Ključne riječi za pregled bile su: terapija pokretom niskog intenziteta, učinak, koristi, znanstveni dokazi, fizioterapija.

Rezultati: Pronađeno je ukupno 378 radova. U ovom preglednom radu izdvojeno je 11 studija koje su zadovoljile kriterije uključivanja i isključivanja.

Zaključak: Dobiveni rezultati potvrđuju važnost primjene terapije pokretom niskog intenziteta u fizioterapiji kao sigurne i učinkovite za pacijente. Istraživanja pokazuju učinak terapije niskog intenziteta na bol, ravnotežu, pokretljivost, psihičko zdravlje i kvalitetu života.

Ključne riječi: fizioterapija, terapija pokretom niskog intenziteta, rehabilitacija, kvaliteta života, sigurnost pacijenta

ABSTRACT

Introduction: Movement therapy represents one of the oldest methods in physiotherapy, with some records indicating that it has existed for more than 6000 years. It is an essential component of the rehabilitation of patients after illness, injuries, or surgical procedures. The aim of this study was to collect clear scientific evidence on the effects of low-intensity movement therapy on pain, muscle strength, balance, general mobility, cardiovascular function and psychological health, as well as quality of life and patient safety.

Methods: A literature review was conducted by searching relevant databases, including PubMed, MEDLINE, Cochrane, SCOPUS, and Hrčak. The keywords used for the review were: low-intensity movement therapy, effects, benefits, scientific evidence, and physiotherapy.

Results: A total of 378 papers were found. In this review, 11 studies were selected that met the inclusion and exclusion criteria.

Conclusion: The results obtained confirm the importance

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of using low-intensity movement therapy in physiotherapy as safe and effective for patients. Research shows the effect of low-intensity movement therapy on pain, balance, mobility, psychological health and quality of life.

Keywords: physiotherapy, low-intensity movement therapy, rehabilitation, quality of life, patient safety



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UVOD

Očuvanje, obnova i poboljšanje pokretljivosti jedan je od osnovnih ciljeva fizioterapijskih intervencija (1,2). Općenito je priznat značaj odgovarajućeg opterećenja pri terapiji pokretom kako bi se postigle ciljane vrijednosti u fizioterapiji i odgovarajuće fiziološke prilagodbe što bi govorilo u prilog terapiji pokretom višeg intenziteta jer veći intenzitet vježbanja može pružiti snažniji podražaj za neuromuskularne, kardiorespiratorne i metaboličke adaptacije, pod uvjetom da je siguran i prilagođen individualnim sposobnostima pacijenta (3). Posljednjih godina sve više istraživanja upućuje na značajnije zdravstvene koristi terapije pokretom niskog intenziteta (4-6). Terapija pokretom niskog intenziteta odnosi se na oblik tjelesne aktivnosti koji koristi blage do umjerene i kontrolirane pokrete u fizioterapiji, a mogu uključivati:

- Lagano hodanje
- Vježbe istezanja
- Blage vježbe snage s minimalnim opterećenjem
- Tai chi
- Jugu prilagođenu početnicima ili osobama sa zdravstvenim ograničenjima
- Vježbe mobilnosti zglobova
- Vježbe pod nadzorom fizioterapeuta (7).

Cilj ovog rada bio je prikupiti jasne znanstvene dokaze o učincima terapije pokretom niskog intenziteta na bol, mišićnu snagu, ravnotežu, opću pokretljivost, kardiovaskularnu funkciju i psihološko zdravlje te kvalitetu života i sigurnost pacijenta.

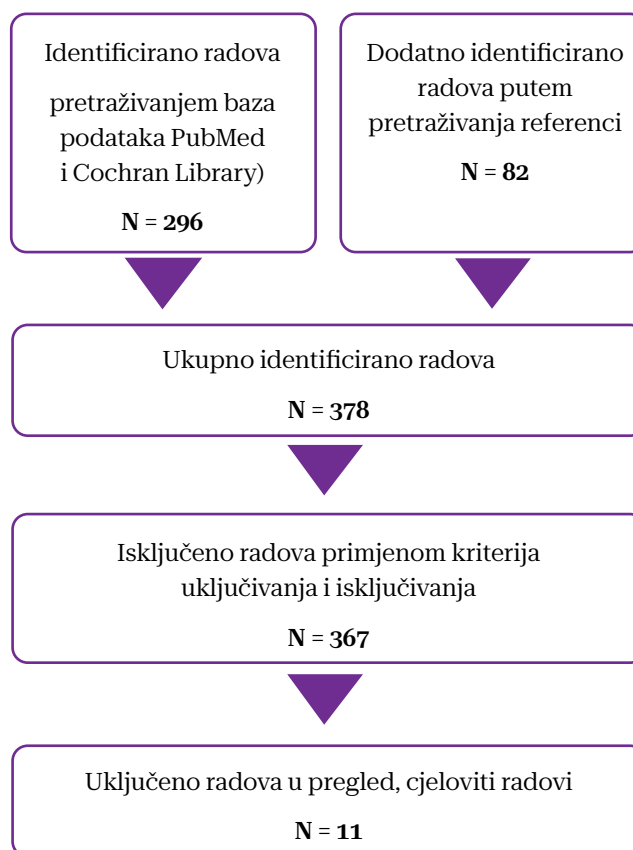
METODE

Proveden je pregled literature pretraživanjem relevantnih baza podataka PubMed, Cochrane, PEDro, Hrčak. Ključne riječi za pregled bile su: terapija pokretom niskog intenziteta, učinak, koristi, znanstveni dokazi, fizioterapija. U pregled su uključeni sustavni pregledi, meta-analize te randomizirana kontrolirana istraživanja objavljena kao cjeloviti radovi na engleskom jeziku u proteklih 10 godina. Kriteriji uključivanja obuhvaćali su istraživanja koja su ispitivala učinke vježbi niskog intenziteta primijenjenih u sklopu fizioterapijskih rehabilitacijskih programa.

Kriteriji isključivanja bili su: radovi koji nisu kvantificirali ishode primijenjenih fizioterapijskih intervencija, radovi koji su uključivali pacijente s onkološkom boli ili kroničnom glavoboljom.

REZULTATI

Pronađeno je 244 radova u bazi PubMed i 52 rada u bazi Cochrane Library. Na slici 1. prikazan je prizma dijagram dok je analiza odabranih radova prikazana u Tablici 1.



Slika 1. Prizma dijagram

Autori, godina	Broj studija ili ispitanika	Intervencije	Glavni ishodi
Amagasa et al., 2018. (4)	24 presječnih istraživanja i 6 longitudinalnih studija	Low intensity physical activity (VNI – vježbe niskog intenziteta)	Učinak VNI je obrnuto proporcionalan riziku od smrtnosti (rizik od smrti značajno manji kod pozitivnih učinaka VNI), VNI je pozitivno povezane s nekim kardiometaboličkim čimbenicima rizika
Chastin et al., 2019., (5)	27 eksperimentalnih studija i 45 opservacijskih studija	VNI	VNI poboljšava kardiometaboličko zdravlje i smanjuje rizik od smrtnosti
Ye Y, Liu A., 2011., (8)	6 sustavnih pregleda	VNI	VNI djeluje na smanjenje boli, povećanje pokretljivosti kod osteoartritisa koljena
Zhao A et al., 2025. (9)	28 RTC	VNI	VNI djeluje na smanjenje boli, poboljšava pokretljivost kod osteoartritisa koljena
Nuuttila OP, Matomäki P, Raitanen J, Sievänen H, Vasankari T., 2026. (10)	50 RTC	VNI	VNI poboljšale aerobnu kondiciju i kardiometaboličko zdravlje
White et al., 2024. (11)	247 RTC	VNI	VNI pozitivno utječu na mentalno zdravlje
Singh B, et al., 2025. (12)	133 sustavna pregleda	Tjelovježba (uključujući VNI)	Tjelovježba (uključujući VNI) koristi općoj kognitivnoj sposobnosti, pamćenju i izvršnim funkcijama
Yi Leung SK et al., 2024. (13)	25 RTC	Nefarmakološke intervencije (uključujući VNI)	Pozitivan učinak na liječenje kronične boli, smanjenje katastrofizirajućih uvjerenja i smanjenje depresivnih simptoma uz poboljšanje tjelesnih performansi
Guan-Cheng Z, Kuei-Min C, Belcastro F, 2024. (14)	14 sustavnih pregleda	Tai chi, pilates, joga	Pozitivan utjecaj na smanjenje boli (najveći učinak pokazuje Tai chi), Nedovoljno dokaza na smanjenje onesposobljenosti / invalidnosti
Hayden JA, Ellis J, Ogilvie R, Malmivaara A, van Tulder MW, 2021. (15)	249 RTC	Vježbe (uključujući VNI)	Vježbe djeluju na smanjenje boli i funkcionalnog ograničenja
Yang GY et al. 2022. (16)	210 sustavnih pregleda	VNI - Tai chi	Rezultati sugeriraju da Tai chi ima multidimenzionalne učinke no najdosljedniji su na smanjenje rizika od padova, boli i pokretljivosti kod osteoartritisa koljena, boli kod križbolje

Tablica 1. Lista uključenih radova

RASPRAVA

Sintagme „vježbe niskog intenziteta“, „aktivnosti niskog intenziteta“ mogu se odnositi na aktivnosti niskog do umjerenog opterećenja i/ili niskog metaboličkog zahtjeva (npr. aerobne aktivnosti nižeg zahtjeva, hodanje, sustavni programi vježbanja poput Tai chi vježbanja, pilatesa, vježbe stabilnosti i ravnoteže, vježbe u vodenom

mediju). U razdoblju od 2016. – 2026. godine najveći broj kvalitetnih dokaza dolazi iz studija koje su istraživale područje kontrole kronične boli, starije populacije, osteoartritisa, križbolje, neurorehabilitacije i prevencije padova (4,5,8-16).

Glavni nalazi istraživanja:

1. Smanjenja boli kod kronične nespecifične križobolje, osteoartritisa koljena i kuka, kronične boli u vratu, fibromialgije, kronične boli u starijih osoba
2. Poboljšanje funkcionalne sposobnosti:
 - Ravnoteža
 - Pokretljivost
 - Hodanje
 - Izvođenje aktivnosti svakodnevnog života
 - Kvaliteta života.
3. Sigurnost

Jedna od najvećih prednosti vježbi niskog intenziteta je sigurnost pacijenta:

- Nizak rizik od ozljeda
 - Visoka razina suradljivosti pacijenta
 - Mala stopa odustajanja
 - Dobra podnošljivost
 - Mogućnost dugotrajnog provođenja.
4. Trajanje
 - Najbolji rezultati postižu se kod primjene vježbi niskog intenziteta 8-12 tjedana.
 - Kod dugotrajne primjene, više od tri mjeseca nema većeg odustanka

Stoga se preporučuju:

- Starijim osobama
- Osobama nakon operacije
- Osobama koje tek započinju rehabilitaciju
- Pacijentima sa kroničnim stanjima ili bolestima.

Sustavi vježbanja niskog intenziteta poput Tai chia koji su strukturirani, lako se uče i dovoljno su motivirajući da kod dugotrajne primjene nema većeg odustanka garantiraju pozitivne učinke na ravnotežu, opću pokretljivost i kvalitetu života (14,16).

ZAKLJUČAK

Istraživanja o učincima fizioterapije, gdje su okosnicu činile vježbe niskog intenziteta u posljednjih deset godina pokazuju sve snažnije dokaze o njihovom pozitivnom djelovanju na bol, mišićnu snagu, ravnotežu, opću pokretljivost, kardiovaskularnu funkciju i psihološko zdravlje te kvalitetu života. Superiornost vježbi niskog intenziteta posebno se očituje u programima rane rehabilitacije, kod osoba s kroničnom boli mišićno-koštano sustava, osteoartritisa, fibromialgije.

Učinak je pozitivan u kontroli kronične mišićno-koštane boli, poboljšanju ravnoteže i stabilnosti, pokretljivosti,

u izvedbi aktivnosti svakodnevnog života i posljedično poboljšanju kvalitete života. Jedna od najvećih prednosti vježbi niskog intenziteta je sigurnost pacijenta.

Najčešće korištene vježbe niskog intenziteta u fizioterapiji su hodaње i progresivno povećanje aktivnosti, vježbe u vodenom mediju, vježbe ravnoteže i funkcionalne vježbe, lagane aerobne i mobilizacijske vježbe, tzv. Mind-body pristupi (npr. Tai chi, pilates, joga i spore kontrolirane kretnje). Preporučeno trajanje programa vježbanja je 8-12 tjedana, a može kao kućni program trajati i više mjeseci. Kasnije se vježbe niskog intenziteta preporučuju provoditi kao jedan od zdravih stilova života.

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PROCJENA RAZINE TJELESNE AKTIVNOSTI PRIMJENOM MEĐUNARODNOG UPITNIKA O TJELESNOJ AKTIVNOSTI (IPAQ): PRESJEČNO ISTRAŽIVANJE

Assessment of physical activity levels using the international physical activity questionnaire (IPAQ): a cross-sectional study

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SAŽETAK

Uvod: Tjelesna aktivnost ima ključnu ulogu u očuvanju zdravlja i prevenciji kroničnih bolesti, no njezina razina nije dovoljno istraжена među fizioterapeutima, unatoč njihovoj važnoj ulozi u promicanju zdravih životnih navika. Cilj rada je procijeniti razinu tjelesne aktivnosti među fizioterapeutima na području Hrvatske primjenom Međunarodnog upitnika o tjelesnoj aktivnosti – kratka verzija (IPAQ-SF) te utvrditi postoje li razlike u razini tjelesne aktivnosti s obzirom na spol.

Metode: Provedeno je presječno istraživanje među zaposlenim fizioterapeutima u Republici Hrvatskoj na uzorku od 55 ispitanika putem anonimnog online upitnika. Prikupljeni su demografski i radni podaci te je razina tjelesne aktivnosti procijenjena pomoću validiranog IPAQ-SF upitnika, koji rezultate prikazuje kao kategorije ili u MET-minutama tjedno. Podaci su analizirani metodama deskriptivne i inferencijalne statistike. Ukupna tjelesna aktivnost izračunata je prema IPAQ-SF protokolu i izražena u MET-min/tjedan, a ispitanici su klasificirani prema razini tjelesne aktivnosti. Razlike između spolova analizirane su Mann-Whitney U testom uz razinu značajnosti $p < 0,05$.

Rezultati: Ispitanici su bili najaktivniji u hodaњу, koje je bilo prisutno gotovo svakodnevno, dok je intenzivna tjelesna aktivnost bila rjeđe zastupljena. Medijan ukupne tjelesne aktivnosti iznosio je 5976 MET-min/tjedan. Prema IPAQ klasifikaciji, 78,2% ispitanika imalo je visoku, 12,7% umjerenu, a 9,1% nisku razinu tjelesne aktivnosti. Prosječno vrijeme provedeno sjedeći iznosilo je 297 minuta dnevno. Nisu utvrđene statistički značajne razlike u razini tjelesne aktivnosti prema spolu ($p = 0,647$).

Zaključak: Ispitanici su općenito bili tjelesno aktivni, uz istodobnu prisutnost značajnog vremena provedenog sjedeći. Nisu utvrđene statistički značajne razlike u razini tjelesne aktivnosti između muškaraca i žena.

Ključne riječi: *fizioterapeut, javno zdravstvo, tjelesna aktivnost, zdravlje*

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ABSTRACT

Introduction: Physical activity plays a key role in maintaining health and preventing chronic diseases; however, its level has not been sufficiently investigated among physiotherapists despite their important role in promoting healthy lifestyle habits. The aim of this paper is to assess the level of physical activity among physiotherapists in Croatia using the International Physical Activity Questionnaire – Short Form (IPAQ-SF) and to determine whether differences in physical activity levels exist according to sex.

Methods: A cross-sectional study was conducted among employed physiotherapists in the Republic of Croatia on a sample of 55 participants using an anonymous online questionnaire. Demographic and work-related data were collected, and physical activity levels were assessed using the validated IPAQ-SF questionnaire, which presents results as categories or in MET-minutes per week. Data were analyzed using descriptive and inferential statistical methods. Total physical activity was calculated according to the IPAQ-SF protocol and expressed in MET-min/week, and participants were classified according to their level of physical activity. Differences between sexes were analyzed using the Mann-Whitney U test, with the level of statistical significance set at $p < 0.05$.

Results: Participants were most active in walking, which was performed almost daily, whereas vigorous physical activity was less frequent. The median total physical activity was 5,976 MET-min/week. According to the IPAQ classification, 78.2% of participants had a high level of physical activity, 12.7% had a moderate level, and 9.1% had a low level of physical activity. The average daily sitting time was 297 minutes. No statistically significant differences in physical activity levels were found between males and females ($p = 0.647$).

Conclusion: Participants were generally physically active, although considerable sedentary time was observed. No statistically significant differences in physical activity levels were found between males and females.

Keywords: physiotherapist, public health, physical activity, health



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UVOD

Procjena razine tjelesne aktivnosti predstavlja važan aspekt u očuvanju i unaprjeđenju zdravlja, budući da je redovita tjelesna aktivnost povezana sa smanjenim rizikom od brojnih kroničnih nezaraznih bolesti. Svjetska zdravstvena organizacija (SZO) definira tjelesnu aktivnost kao bilo koji tjelesni pokret koji proizvode skeletni mišići i koji zahtijeva potrošnju energije. Tjelesna aktivnost obuhvaća sve pokrete, uključujući one tijekom slobodnog vremena, pri kretanju s jednog mjesta na drugo (prijevoz), kao i aktivnosti u sklopu rada ili kućanskih poslova. Popularni načini tjelesne aktivnosti uključuju hodanje, vožnju bicikla, kretanje uz pomoć pomagala (npr. invalidskih kolica), sport, aktivnu rekreaciju i igru, te ih mogu prakticirati svi, bez obzira na razinu vještine, radi užitka. Tjelesna aktivnost korisna je za zdravlje i dobrobit, dok tjelesna neaktivnost povećava rizik od nezaraznih bolesti i drugih nepovoljnih zdravstvenih ishoda. Zajedno, tjelesna neaktivnost i sjedilački način ponašanja doprinose porastu nezaraznih bolesti i predstavljaju opterećenje za zdravstvene sustave (1).

Prema Smjernicama SZO-a za tjelesnu aktivnost i sjedilačko ponašanje, odrasle osobe trebale bi provoditi najmanje 150–300 minuta umjerene aerobne tjelesne aktivnosti tjedno ili najmanje 75–150 minuta intenzivne aerobne aktivnosti, odnosno ekvivalentnu kombinaciju aktivnosti umjerenog i visokog intenziteta. Također se preporučuje provođenje aktivnosti za jačanje mišića najmanje dva puta tjedno te ograničavanje vremena provedenog u sjedilačkom ponašanju (2).

Unatoč dobro poznatim zdravstvenim koristima redovite tjelesne aktivnosti, tjelesna neaktivnost i dalje predstavlja značajan javnozdravstveni problem. Prema najnovijim procjenama, približno 31% odrasle svjetske populacije (1,8 milijardi) ne zadovoljava preporučene (najmanje 150 minuta umjerene tjelesne aktivnosti tjedno) razine tjelesne aktivnosti, pri čemu su žene i starije osobe češće nedovoljno aktivne u usporedbi s muškarcima i mlađim dobnim skupinama. Predviđa se da bi, ako se postojeći trendovi nastave, udio tjelesno neaktivnih odraslih osoba mogao doseći 35 % do 2030. godine (3).

Dobna skupina	Preporuke
Odrasle osobe (18 – 64 g.)	Preporučuje se provoditi 150 – 300 minuta na tjedan u aerobnim aktivnostima umjerenog intenziteta ili 75 - 150 minuta na tjedan u aerobnim aktivnostima visokog intenziteta ili kombinirati aerobne aktivnosti umjerenog i visokog intenziteta u odgovarajućem ukupnom trajanju. Aerobne aktivnosti umjerenog intenziteta jesu one koje iziskuju umjeren tjelesni napor i pri kojima se osoba zadiše i/ili lagano oznoji, a primjeri takvih aktivnosti jesu: žustro hodanje, umjereno brza vožnja biciklom, aerobika u vodi i sl. Aerobne aktivnosti visokog intenziteta su one koje iziskuju težak tjelesni napor i pri kojima se osoba znatno zadiše i oznoji, a primjeri takvih aktivnosti jesu: trčanje, žustro nordijsko hodanje, plivanje, grupna aerobika i sl. Poželjno je da se aerobna aktivnost ravnomjerno rasporedi kroz cijeli tjedan te da pojedinačne epizode aktivnosti traju najmanje 10 minuta u kontinuitetu. Aktivnosti za jačanje mišića trebaju se provoditi najmanje 2 puta na tjedan i uključivati sve velike mišićne skupine. Primjeri takvih aktivnosti jesu: vježbanje s utezima, vježbanje pri kojem se svladava vlastita tjelesna masa (npr., sklekovi, čučnjevi, trbušnjaci) i vježbanje na spravama u teretani. - Preporučena razina tjelesne aktivnosti može se ostvariti sudjelovanjem u aktivnostima tijekom slobodnog vremena, ali i u ostalim domenama svakodnevnog života (u transportu, kućanstvu i na poslu). Važno je da se ne pretjera s kontinuiranim periodima statičnog stajanja ili niskointenzivne tjelesne aktivnosti.
Osobe sa zdravstvenim problemima, aktivnosti trebaju prilagoditi svojim mogućnostima u dogovoru s liječnikom.	

Slika 1. Preporuke za tjelesnu aktivnost prema Svjetskoj zdravstvenoj organizaciji (WHO, 2020.).

Izvor: <https://recroatia.hr/wp-content/uploads/2020/12/WHO-preporuke.pdf>.

Na globalnoj razini postoje značajne razlike u razinama tjelesne neaktivnosti s obzirom na dob i spol. Žene su u prosjeku manje aktivne od muškaraca za oko 5 postotnih bodova, a taj se odnos nije promijenio od 2000. godine. Nakon 60. godine života razine tjelesne neaktivnosti rastu i kod muškaraca i kod žena (3).

Čak 81% adolescenata u dobi od 11 do 17 godina ne zadovoljava preporučene razine tjelesne aktivnosti (4).

Adolescentice su manje aktivne od adolescenata, pri čemu 85% djevojaka u odnosu na 78% mladića ne zadovoljava smjernice SZO-a (4).

Na razinu tjelesne aktivnosti utječe niz različitih čimbenika. Oni mogu biti povezani s pojedincem, ali i sa širim društvenim, kulturnim, okolišnim i ekonomskim odrednicama koje utječu na pristup i mogućnosti za tjelesnu aktivnost na siguran i ugodan način (5).

Nekoliko uobičajenih instrumenata dostupno je za mjerenje tjelesne aktivnosti, uključujući upitnike samoprocjene, indirektnu kalorimetriju, izravno promatranje, telemetriju srčane frekvencije i senzore pokreta. Jedan od najčešće korištenih instrumenata u epidemiološkim i

populacijskim istraživanjima za procjenu razine tjelesne aktivnosti je Međunarodni upitnik o tjelesnoj aktivnosti (International Physical Activity Questionnaire – IPAQ). Dostupan je u dugoj (IPAQ-LF) i kratkoj verziji (IPAQ-SF), pri čemu kratka verzija sadrži sedam pitanja kojima se procjenjuju intenzivna tjelesna aktivnost, umjerena tjelesna aktivnost, hodanje i vrijeme provedeno sjedeći tijekom posljednjih sedam dana. Zbog jednostavnosti primjene, prihvatljive pouzdanosti i mogućnosti usporedbe rezultata među različitim populacijama, IPAQ-SF često se koristi u istraživanjima tjelesne aktivnosti odraslih osoba (6,7).

Izvorni autori preporučili su verziju IPAQ-SF-a koja se odnosi na „prisjećanje posljednjih 7 dana” za istraživanja praćenja tjelesne aktivnosti, dijelom zato što je opterećenje za sudionike pri izvještavanju o vlastitoj aktivnosti malo (8).

Unatoč dobro poznatim koristima, nedovoljna razina tjelesne aktivnosti i dalje je prisutna u velikom dijelu populacije, uključujući i zdravstvene djelatnike, stoga je cilj ovog presječnog istraživanja procijeniti razinu tjelesne aktivnosti među fizioterapeutima na području Republike

Hrvatske te utvrditi postoje li razlike u razini tjelesne aktivnosti s obzirom na spol. Dobiveni podaci mogli bi pridonijeti boljem razumijevanju zdravstvenih navika ove skupine te potencijalno utjecati na razvoj strategija za unaprjeđenje zdravlja i radne učinkovitosti.

METODE RADA

Istraživanje je provedeno kao presječno (eng. *cross-sectional*) s ciljem procjene razine tjelesne aktivnosti među zaposlenim fizioterapeutima u Republici Hrvatskoj. Uzorak od 55 ispitanika prikupljen je putem online upitnika (Slika 2.) distribuiranog kroz društvene mreže i profesionalne grupe fizioterapeuta.

Kriteriji uključenja bili su: osobe ženskog i muškog spola, stariji od 18 godina, završen studij fizioterapije, aktivno zaposlenje u struci na području Republike Hrvatske, dobrovoljni pristanak za sudjelovanje.

Upitnikom su se prikupljali i demografski podaci: dob, spol, godine radnog iskustva, radno okruženje, broj radnih sati tjedno, subjektivnu procjenu fizičkog opterećenja na random mjestu.

Za procjenu razine tjelesne aktivnosti korišten je već spomenuti IPAQ-SF koji se sastoji od 7 pitanja i procjenjuje intenzivnu tjelesnu aktivnost, umjerenu tjelesnu aktivnost, hodaње i vrijeme provedeno sjedeći tijekom posljednjih 7 dana. IPAQ-SF predstavlja validiran i široko korišten instrument za procjenu tjelesne aktivnosti u populacijskim istraživanjima (3).

Pouzdanost kratke verzije IPAQ upitnika za Hrvatsku je na zadovoljavajućoj razini kako za ukupnu tjelesnu aktivnost, tako i za pojedinu kategoriju tjelesne aktivnosti (Na temelju rezultata izračunati su Spearman koeficijenti korelacije između test i retesta za ukupnu tjelesnu aktivnost (TA) koji iznosi (0.64) i za pojedine kategorije tjelesne aktivnosti (0.91-0.54)) (9).

Rezultati se prikazuju kategorijski (niska, umjerena ili visoka razina tjelesne aktivnosti) ili kao kontinuirana varijabla izražena u MET-minutama tjedno (MET-min/tjedan). MET-minute predstavljaju količinu energije utrošene tijekom obavljanja tjelesne aktivnosti. MET (metabolički ekvivalent zadatka) predstavlja višekratnik procijenjene potrošnje energije u mirovanju. Jedan MET odgovara količini energije koju osoba troši u stanju mirovanja, dok

MEĐUNARODNI UPITNIK O TJELESNOJ AKTIVNOSTI

Ovim upitnikom se ispituju vrste tjelesnih aktivnosti koje se provode kao dio svakodnevnog života. Kroz niz pitanja ćete odgovarati o količini vremena koje ste utrošili u provođenju određenog tipa tjelesne aktivnosti **unazad 7 dana**. Molimo odgovorite na svako pitanje čak i u slučaju da se ne smatrate osobom koja je tjelesno aktivna. Molimo Vas da se prisjetite svih aktivnosti koje provodite na poslu, u kući i oko kuće, u vrtu, na putu s jednog mjesta na drugo i tijekom slobodnog vremena za rekreaciju, vježbanje i sport.

Prisjetite se svih **izrazito napornih** i **umjerenih** aktivnosti koje ste provodili u **zadnjih 7 dana**. **Izrazito naporne** tjelesnim aktivnostima se smatraju aktivnosti koje uzrokuju teški tjelesni napor i tijekom kojih dišete puno brže od uobičajenog. Prisjetite se **samo** aktivnosti koje ste provodili bez prekida tijekom najmanje 10 minuta.

1. Tijekom **zadnjih 7 dana**, koliko ste dana obavljali **izrazito naporne** tjelesne aktivnosti kao što su na primjer dizanje teških predmeta, kopanje, aerobik ili brza vožnja bicikla?

_____ dana u tjednu

☐

Nisam obavljao izrazito naporne tjelesne aktivnosti



Prijedite na pitanje 3.

2. U danima kada ste obavljali **izrazito naporne** tjelesne aktivnosti, koliko ste ih vremena uobičajeno provodili?

_____ sati u danu

_____ minuta u danu

☐

Ne znam/Nisam siguran

Prisjetite se svih **umjerenih** tjelesnih aktivnosti koje ste provodili u **zadnjih 7 dana**. **Umjerenim** aktivnostima se smatraju aktivnosti koje uzrokuju umjereni tjelesni napor i tijekom kojih dišete nešto brže od uobičajenog. Prisjetite se samo aktivnosti koje ste provodili bez prekida tijekom najmanje 10 minuta.

3. Tijekom **zadnjih 7 dana**, koliko ste dana obavljali **umjerene** tjelesne aktivnosti poput na primjer nošenja lakog tereta, redovite vožnje bicikla ili igranje tenisa? Molimo, nemojte uključiti hodaње.

_____ dana u tjednu

☐

Nisam obavljao umjerenu tjelesnu aktivnost



Prijedite na pitanje 5.

4. U danima kada ste se bavili **umjerenim** tjelesnim aktivnostima, koliko ste ih vremena uobičajeno provodili?

_____ sati u danu

_____ minuta u danu

☐

Ne znam/Nisam siguran

Razmislite o vremenu koje ste proveli **hodaјуći** tijekom **zadnjih 7 dana**. To uključuje hodaње na poslu i kod kuće, hodaње radi putovanja s jednog mjesta na drugo i bilo koje drugo hodaње koje ste obavljali isključivo u svrhu rekreacije, sporta, vježbanja ili provođenja slobodnog vremena.

5. Tijekom **zadnjih 7 dana**, koliko ste dana **hodali** u trajanju od najmanje 10 minuta bez prekida?

_____ dana u tjednu

☐

Nisam toliko dugo hodao



Prijedite na pitanje 7.

6. U danima kada ste toliko dugo **hodali**, koliko ste vremena uobičajeno proveli hodaјуći?

_____ sati u danu

_____ minuta u danu

☐

Ne znam/Nisam siguran

Posljednje pitanje odnosi se na vrijeme koje ste proveli u **sjedećem položaju** tijekom **zadnjih 7 dana**. To uključuje vrijeme provedeno na poslu, kod kuće, tijekom učenja i tijekom slobodnog vremena. Ovim dijelom upitnika je obuhvaćeno na primjer vrijeme provedeno u sjedećem položaju za stolom, pri posjetu prijateljima te vrijeme provedeno u sjedećem ili ležećem položaju za vrijeme čitanja ili gledanja televizije.

7. Unazad **7 dana**, koliko ste vremena uobičajeno provodili **sjedeći** tijekom jednog **radnog dana**?

_____ sati u danu

_____ minuta u danu

☐

Ne znam/Nisam siguran

Ovo je kraj upitnika, hvala na sudjelovanju.

Slika 2. Međunarodni upitnik o tjelesnoj aktivnosti – kratka verzija (IPAQ-SF).

Izvor: <https://sites.google.com/view/ipaq/download>.

2 MET-a predstavljaju dvostruko veću potrošnju energije od one u mirovanju. Za izračun kontinuiranog rezultata IPAQ upitnika (MET-min/tjedan) koriste se standardne MET vrijednosti: hodanje= 3,3 MET-a, umjerena tjelesna aktivnost= 4,0 MET-a i intenzivna tjelesna aktivnost= 8,0 MET-a (10).

Rezultati IPAQ upitnika klasificiraju se u tri kategorije tjelesne aktivnosti: visoka, umjerena i niska razina tjelesne aktivnosti.

Visoka razina tjelesne aktivnosti prema IPAQ-u podrazumijeva razinu aktivnosti koja približno odgovara najmanje jednom satu tjelesne aktivnosti umjerenog ili višeg intenziteta dnevno.

U ovu kategoriju svrstavaju se ispitanici koji ispunjavaju jedan od sljedećih kriterija:

- intenzivna tjelesna aktivnost tijekom najmanje 3 dana tjedno uz ukupnu tjelesnu aktivnost od najmanje 1500 MET-min/tjedan
- više dana bilo koje kombinacije hodanja, umjerene i intenzivne tjelesne aktivnosti uz ukupnu tjelesnu aktivnost od najmanje 3000 MET-min/tjedan.

Umjerena razina tjelesne aktivnosti označava provođenje tjelesne aktivnosti koja približno odgovara najmanje 30 minuta aktivnosti umjerenog intenziteta tijekom većine dana u tjednu.

U ovu kategoriju svrstavaju se ispitanici koji ispunjavaju jedan od sljedećih kriterija:

- intenzivna tjelesna aktivnost i/ili hodanje tijekom najmanje 3 dana tjedno u trajanju od najmanje 30 minuta dnevno
- umjerena tjelesna aktivnost i/ili hodanje tijekom najmanje 5 dana tjedno u trajanju od najmanje 30 minuta dnevno
- 5 ili više dana bilo koje kombinacije hodanja, umjerene i intenzivne tjelesne aktivnosti uz ukupnu tjelesnu aktivnost od najmanje 600 MET-min/tjedan.

Niska razina tjelesne aktivnosti odnosi se na ispitanike koji ne zadovoljavaju kriterije za umjerenu niti visoku razinu tjelesne aktivnosti (10).

Ukupna tjelesna aktivnost izračunata je prema službenom IPAQ-SF protokolu te izražena u MET-min/tjedan, nakon čega su ispitanici klasificirani u skupine niske, umjerene i visoke razine tjelesne aktivnosti.

Statistička obrada podataka provedena je korištenjem Microsoft Excel-a i pomoću softverskog paketa Statistica 13.4 (TIBCO Software, Palo Alto, Kalifornija, SAD). Kategorijske varijable prikazane su frekvencijama i postocima, dok su kontinuirane varijable prikazane srednjim vrijednostima i standardnim devijacijama. Za usporedbu ukupne tjelesne aktivnosti između muškaraca i žena

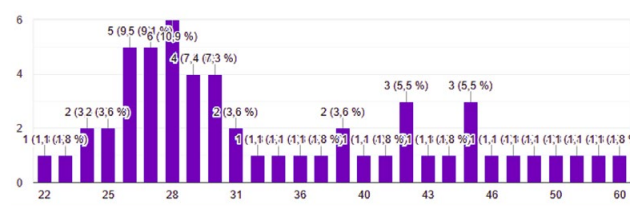
primijenjen je Mann-Whitney U test. Razina statističke značajnosti postavljena je na $p < 0,05$.

Ispitanicima je u uvodnom dijelu upitnika detaljno objašnjen način ispunjavanja istog te je naglašeno da je sudjelovanje u ispunjavanju u potpunosti anonimno i dobrovoljno. Istraživanje je provedeno u skladu s etičkim načelima, a s obzirom na to da je uključivalo isključivo ispunjavanje anonimnog upitnika bez prikupljanja osobnih podataka i bez intervencija, rizik za ispitanike procijenjen je kao minimalan.

REZULTATI

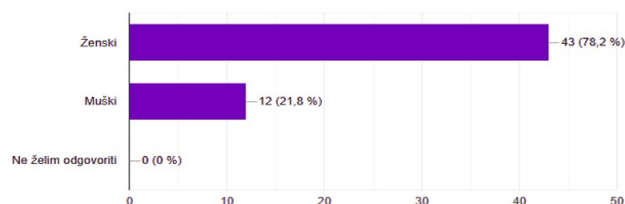
Sociodemografske karakteristike ispitanika

U istraživanju je sudjelovalo 55 ispitanika različite dobi, pri čemu je najviše ispitanika u dobi između 25 i 30 godina. Najčešće pojedinačne vrijednosti kreću se oko 26–29 godina, gdje se bilježi najveći broj odgovora (pojedine dobne skupine imaju i do 5 ispitanika, odnosno oko 9%). Starije dobne skupine (iznad 40 godina) zastupljene su u manjem broju, a raspodjela pokazuje desno asimetričan oblik, s većinom ispitanika u mlađoj odrasloj dobi (Grafikon 1).



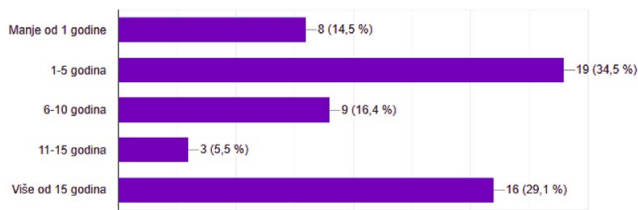
Grafikon 1. Raspodjela ispitanika prema dobi.

Uzorak je izrazito ženski dominantan, što je u skladu s trendovima u fizioterapijskoj struci. Od ukupnog broja ispitanika (43; 78,2%) su žene i (12; 21,8%) su muškarci (Grafikon 2).



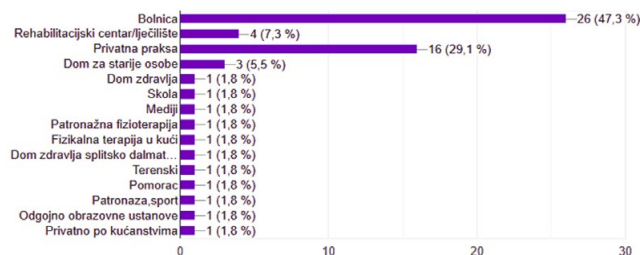
Grafikon 2. Raspodjela ispitanika prema spolu.

Distribucija odgovora vezanih uz radon iskustvo je dvodijelna - jedna skupina su mlađi ispitanici s malo iskustva, a druga iskusni fizioterapeuti. Najveći broj ispitanika ima 1–5 godina iskustva: (19; 34,5%), više od 15 godina: (16; 29,1%), dok ostale skupine: manje od 1 godine (8; 14,5%), 6–10 godina (9; 16,4%), 11–15 godina (3; 5,5%) (Grafikon 3).



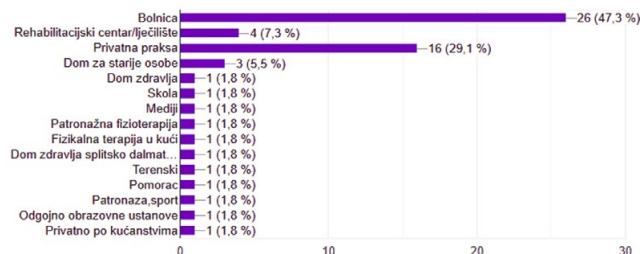
Grafikon 3. Raspodjela ispitanika prema duljini radnog iskustva.

Najveći broj ispitanika radi u bolnici (26; 47,3%) i privatnoj praksi (16; 29,1%) dok su manje zastupljeni rehabilitacijski centri (4; 7,3%) i domovi za starije (3; 5,5%) (Grafikon 4).



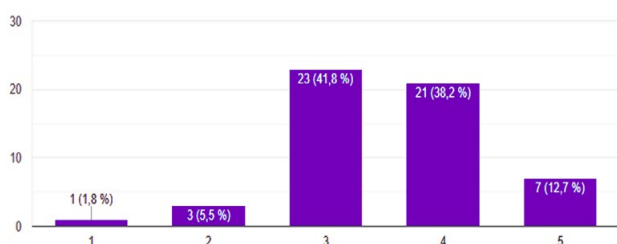
Grafikon 4. Raspodjela ispitanika prema području rada.

Najveći broj ispitanika radi 20–40 sati tjedno (29; 52,7%) i 41–50 sati (20; 36,4%) dok manji broj radi više od 50 sati (4; 7,3%) i manje od 20 sati (2; 3,6%) (Grafikon 5).



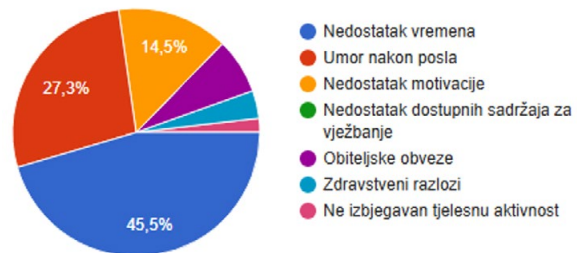
Grafikon 5. Raspodjela ispitanika prema broju radnih sati tjedno.

Većina ispitanika doživljava svoje radno mjesto kao umjeren do visoko fizički zahtjevno. Ispitanici su procjenjivali opterećenje na skali 1–5: najčešći odgovori su 3 (23; 41,8%) i 4 (21; 38,2%), dok su manje zastupljeni 5 (visoko opterećenje) (7; 12,7%), 2 (3; 5,5%) i 1 (1; 1,8%) (Grafikon 6).



Grafikon 6. Procjena razine fizičkog opterećenja na radnom mjestu.

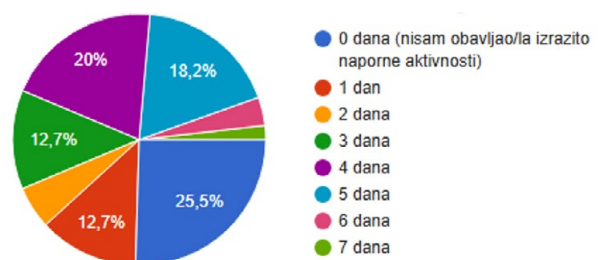
Na Grafikonu 7 prikazani su najčešći razlozi koji sprječavaju ispitanike u redovitom bavljenju tjelesnom aktivnošću. Najveći udio ispitanika navodi nedostatak vremena (45,5%) kao glavni ograničavajući čimbenik. Također, značajnu prepreku predstavlja umor nakon posla (27,3%). Kao treći najčešći razlog navodi se nedostatak motivacije (14,5%). Ostali razlozi, poput obiteljskih obveza, zdravstvenih razloga i nedostatka dostupnih sadržaja za vježbanje, zastupljeni su u znatno manjem postotku. Mali udio ispitanika navodi da ne izbjegava tjelesnu aktivnost.



Grafikon 7. Najčešći razlozi u sprječavaju u redovitom bavljenju tjelesnom aktivnošću.

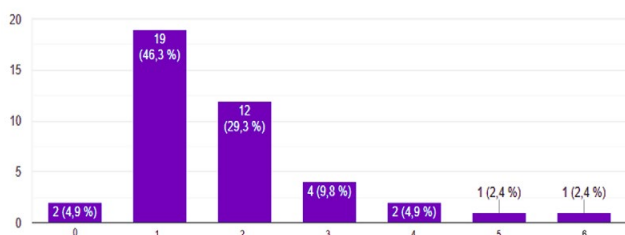
Tjelesna aktivnost prema IPAQ-SF domenama

Učestalost provođenja intenzivne tjelesne aktivnosti (npr. dizanje teških predmeta, kopanje, aerobik, brza vožnja bicikla) tijekom posljednjih 7 dana prikazana je na Grafikonu 8. Najveći udio ispitanika navodi da nije provodio ovakvu vrstu aktivnosti (0 dana – 25,5%). S druge strane, značajan broj ispitanika bio je aktivan 4 dana (20%) te 5 dana (18,2%). Također, 12,7% ispitanika navodi da je intenzivne aktivnosti provodio 2 ili 3 dana u tjednu. Ostale kategorije zastupljene su u manjem postotku.



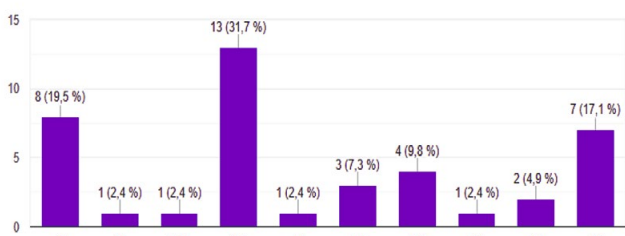
Grafikon 8. Prikaz broja dana u kojima su ispitanici tijekom posljednjih 7 dana provodili intenzivne naporne tjelesne aktivnosti.

Trajanje izražito napornih aktivnosti u danima kada su se provodile prikazano je na Grafikonu 8.1. Najveći broj ispitanika navodi trajanje od 1 sat dnevno (46,3%), dok značajan udio provodi 2 sata dnevno (29,3%). Manji broj ispitanika navodi dulje trajanje aktivnosti (3 sata – 9,8%), dok su trajanja od 4 i više sati rijetka. Mali udio ispitanika navodi da ne provodi ovakvu vrstu aktivnosti.



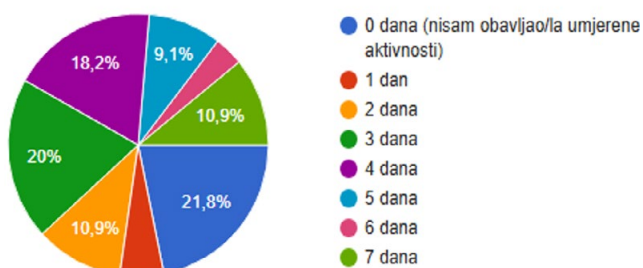
Grafikon 8.1 Prikaz prosječnog broja sati dnevno koje su ispitanici provodili u intenzivnim tjelesnim aktivnostima.

Na Grafikonu 8.2 prikazano je trajanje izražito napornih aktivnosti izraženo u minutama dnevno. Najveći broj ispitanika navodi 30 minuta dnevno (31,7%), dok 17,1% ispitanika navodi oko 60 minuta dnevno. Također, prisutan je i značajan udio ispitanika koji ne provode intenzivnu aktivnost (0 minuta – 19,5%). Ostale vrijednosti (45, 50 minuta i više) zastupljene su u manjem broju.



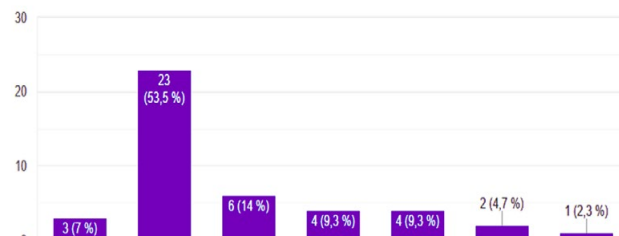
Grafikon 8.2 Prikaz prosječnog broja minuta dnevno koje su ispitanici provodili u intenzivnim tjelesnim aktivnostima.

Učestalost provođenja umjerenih tjelesnih aktivnosti tijekom posljednjih 7 dana prikazana je na Grafikonu 9. Najveći udio ispitanika navodi da nije provodio umjerenu tjelesnu aktivnost (0 dana – 21,8%). S druge strane, značajan dio ispitanika bio je aktivan 3 dana (20%), dok su odgovori za 4 dana (18,2%) i 7 dana (18,2%) također relativno česti. Manji udio ispitanika navodi 2 dana aktivnosti (10,9%), dok su ostale kategorije zastupljene u manjoj mjeri. Zaključno, umjerena tjelesna aktivnost bilježi nešto veću učestalost, prosječno 3 dana tjedno, s trajanjem od oko 183 minute dnevno.



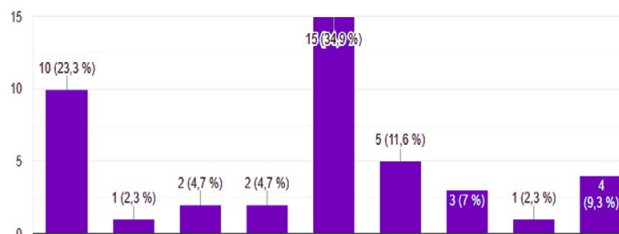
Grafikon 9. Prikaz broja dana u kojima su ispitanici tijekom posljednjih 7 dana provodili umjerene tjelesne aktivnosti (bez uključivanja hodanja).

Trajanje umjerenih tjelesnih aktivnosti u danima kada su se provodile prikazano je na Grafikonu 9.1. Najveći broj ispitanika navodi trajanje od 1 sat dnevno (53,5%), što predstavlja dominantan odgovor. Manji udio ispitanika provodi 2 sata dnevno (14%), dok su dulja trajanja (3, 4 i više sati) zastupljena u znatno manjem postotku. Mali broj ispitanika navodi da uopće ne provodi umjerenu aktivnost.



Grafikon 9.1 Prikaz prosječnog broja sati dnevno koje su ispitanici provodili u umjerenim tjelesnim aktivnostima.

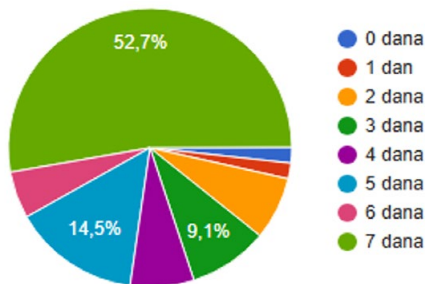
Raspodjela pokazuje da se trajanje aktivnosti najčešće kreće između 30 i 60 minuta dnevno, ali uz prisutnost ispitanika koji su potpuno neaktivni, što dodatno naglašava heterogenost uzorka. Na Grafikonu 9.2 prikazano je trajanje umjerenih aktivnosti izraženo u minutama dnevno. Najčešće zabilježene vrijednosti su 30 minuta (31,7%) i 60 minuta (17,1%), dok dio ispitanika navodi i veće vrijednosti (45 i 50 minuta). Također, prisutan je i određeni udio ispitanika koji ne provode umjerenu aktivnost (0 minuta – 19,5%).



Grafikon 9.2 Prikaz prosječnog broja minuta dnevno koje su ispitanici provodili u umjerenim tjelesnim aktivnostima.

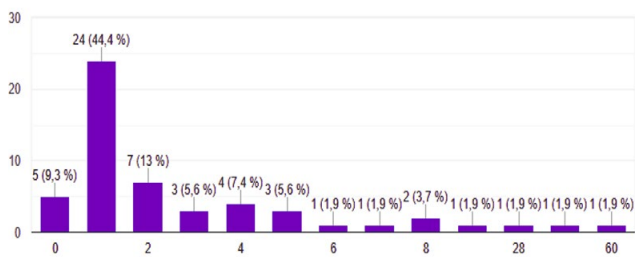
Iako dio ispitanika uopće ne provodi umjerenu tjelesnu aktivnost, većina onih koji su aktivni zadovoljava preporučeno trajanje aktivnosti (30–60 minuta dnevno). Međutim, izražena varijabilnost ukazuje na neujednačene navike unutar uzorka.

Grafikonu 10 prikazuje koliko su dana u tjednu ispitanici hodali najmanje 10 minuta bez prekida. Najveći udio ispitanika, čak 52,7%, navodi da hoda 7 dana u tjednu, što upućuje na svakodnevnu aktivnost. Manji udio ispitanika hodao je: 5 dana (14,5%), 6 dana (9,1%), dok su ostale kategorije (0-4 dana) zastupljene u znatno manjem postotku. Stoga možemo zaključiti da se hodaње pokazalo kao najzastupljeniji oblik tjelesne aktivnosti, s prosječno 5,5 dana tjedno i trajanjem od približno 290 minuta dnevno.



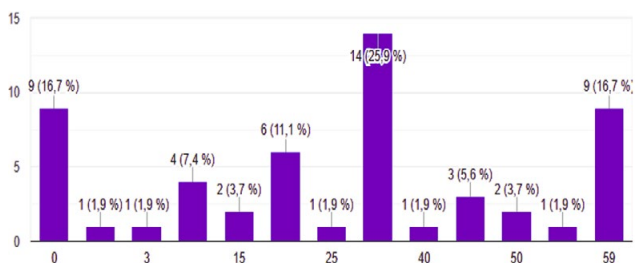
Grafikon 10. Prikaz broja dana u kojima su ispitanici tijekom posljednjih 7 dana hodali najmanje 10 minuta bez prekida.

Trajanje hodanja prikazano je Grafikonom 10.1. Najveći broj ispitanika (24; 44,4%) navodi trajanje od jednog sata dnevno, što je dominantan odgovor. Slijede: 2 sata (13%), 0 sati (9,3%) te ostale vrijednosti (3-8 sati i više) koje su manje zastupljene (ispod 10%). Zaključno, većina ispitanika hoda umjereno dugo (oko sat dnevno), dok su ekstremne vrijednosti rijetke.



Grafikon 10.1 Prikaz prosječnog broja sati dnevno koje su ispitanici provodili u hodanju.

Raspodjela minuta hodanja koja pokazuje najveću koncentraciju odgovora oko 30 minuta dnevno (14; 25,9) prikazana je Grafikonom 10.2. Također se ističu: 0 minuta (16,7%), 59 minuta (16,7%) te ostale vrijednosti (15, 25, 40, 50 min) koje su raspoređene u manjim udjelima. Rezultati ponovno pokazuju varijabilnost među ispitanicima, ali s naglaskom na vrijednosti između 30 i 60 minuta, što odgovara preporukama SZO-a.



Grafikon 10.2 Prikaz prosječnog broja minuta dnevno koje su ispitanici provodili u hodanju.

Unatoč visokoj razini kretanja, ispitanici provode prosječno oko 297 minuta dnevno u sjedećem položaju, odnosno približno 5 sati.

Ukupna tjelesna aktivnost prema IPAQ klasifikaciji

Prema IPAQ klasifikaciji, većina ispitanika (78,2%) svrstana je u skupinu visoke razine tjelesne aktivnosti. Umjerena razina tjelesne aktivnosti zabilježena je kod 12,7% ispitanika, dok je 9,1% ispitanika svrstano u skupinu niske razine tjelesne aktivnosti (Tablica 1).

Medijan ukupne tjelesne aktivnosti iznosio je 5976,0 MET-min/tjedan, dok je prosječna vrijednost iznosila 6553,6 MET-min/tjedan.

Tablica 1. Razina tjelesne aktivnosti prema IPAQ klasifikaciji.

Razina tjelesne aktivnosti	n	%
Niska	5	9,1
Umjerena	7	12,7
Visoka	43	78,2
Ukupno	55	100,0

Razlike u tjelesnoj aktivnosti prema spolu

Analizom ukupne tjelesne aktivnosti prema spolu nije utvrđena statistički značajna razlika između muškaraca i žena (Mann-Whitney U test, $p = 0,647$) (Tablica 2).

Medijan ukupne tjelesne aktivnosti iznosio je 5966,5 MET-min/tjedan kod muškaraca te 5976,0 MET-min/tjedan kod žena.

Tablica 2. Ukupna tjelesna aktivnost prema spolu.

Spol	n	Medijan (MET-min/tjedan)
Muškarci	12	5966,5
Žene	43	5976,0

Ra Mann-Whitney U test: $p = 0,647$ sprava

Prema IPAQ klasifikaciji, više od tri četvrtine ispitanika svrstano je u skupinu visoke razine tjelesne aktivnosti, što potvrđuje da promatrani uzorak fizioterapeuta karakterizira visoka ukupna razina tjelesne aktivnosti. Hodanje se pokazalo kao dominantan oblik tjelesne aktivnosti i prisutno je gotovo svakodnevno kod većine ispitanika, što značajno doprinosi ukupnoj razini tjelesne aktivnosti. Ovakav obrazac posebno je karakterističan za populacije kod kojih se tjelesna aktivnost procjenjuje putem IPAQ-SF upitnika. Razina tjelesne aktivnosti ispitanika djelomično je uvjetovana demografskim i radnim karakteristikama uzorka. S obzirom na to da uzorak čine pretežno mlađi fizioterapeuti, moguće je očekivati višu razinu tjelesne aktivnosti, što je u skladu s prethodnim spoznajama da mlađe dobne skupine općenito pokazuju

višu razinu tjelesne aktivnosti. Nadalje, većina ispitanika zaposlena je u kliničkom, bolničkom okruženju, gdje je radno okruženje povezano s većim fizičkim opterećenjem, što može dodatno doprinositi ukupnoj razini dnevne aktivnosti. Činjenica da većina ispitanika radi u punom radnom vremenu, a značajan dio i produženo radno vrijeme, može imati važnu ulogu u povećanju razine umora te utjecati na obrasce tjelesne aktivnosti izvan radnog okruženja, osobito u kontekstu smanjenja vremena za strukturiranu rekreacijsku aktivnost.

Dodatna analiza nije pokazala statistički značajne razlike u ukupnoj razini tjelesne aktivnosti između muškaraca i žena. Ovakav nalaz treba interpretirati oprezno zbog neravnomjerne spolne zastupljenosti u uzorku, pri čemu su žene činile više od tri četvrtine svih ispitanika. Ipak, rezultati upućuju da su obrasci tjelesne aktivnosti u promatranoj skupini fizioterapeuta relativno ujednačeni neovisno o spolu.

Istraživanje *Lowe i sur. (2017)* na uzorku od 522 ispitanika pokazuje da, unatoč tome što fizioterapeuti često aktivno sudjeluju u promicanju tjelesne aktivnosti kod pacijenata, njihova vlastita razina tjelesne aktivnosti nije uvijek u skladu s preporukama. U navedenom istraživanju samo 38% fizioterapeuta zadovoljava preporučene razine tjelesne aktivnosti, dok je istodobno zabilježeno da fizička aktivnost nije bila povezana s učestalošću promoviranja tjelesne aktivnosti u praksi (77% ispitanika redovito je razgovaralo o tjelesnoj aktivnosti s pacijentima) (11).

Rezultati ovog istraživanja u skladu su s rezultatima koje su dobili *Komen, Vučković i Mihelčić (2024)* na uzorku od 170 ispitanika, koje je pokazalo da, iako fizioterapeuti u Hrvatskoj imaju relativno umjerene i visoke razine tjelesne aktivnosti, ona nije značajno povezana s profesionalnim sagorijevanjem. Navedeno potvrđuje da visoka razina tjelesne aktivnosti ne podrazumijeva nižu razinu profesionalnog opterećenja ili sjedilačkog ponašanja (12).

Uspoređujući rezultate s radom *Ciucurela et al. (2023)*, gdje je uzorak od 60 fizioterapeuta imao prosječnu ukupnu tjelesnu aktivnost od 1927 MET-min/tj prema IPAQ SF-u (38% niska, 40% umjerena, 22% visoka razina tjelesne aktivnosti), naši ispitanici pokazuju slične razine, posebno u segmentu hodanja i umjerene aktivnosti. Uzorak u našem istraživanju izgleda homogenije aktivan. Rezultati istraživanja zapravo pokazuju da fizioterapeuti nisu uvijek visoko aktivni, nego da se razlikuju po razinama aktivnosti. Također, iako je intenzivna aktivnost prisutna u oba istraživanja, ona je u manjini, što potvrđuje da fizioterapeuti češće provode svakodnevne oblike kretanja nego strukturirane visokointenzivne treninge (13).

U glavnoj studiji o fizioterapeutima rezultati istraživanja *Neil-Sztramko et al. (2017)* pokazuju da samoprijavljena aktivnost kod 98 fizioterapeuta često precjenjuje stvarnu

aktivnost u odnosu na akcelerometar (99% fizioterapeuta prema IPAQ-u zadovoljava smjernice, samo 58% prema objektivnom mjerenju - akcelerometar), što upućuje da su rezultati IPAQ SF-a korisni za procjenu navika, ali ih treba interpretirati oprezno s obzirom da postoji moguća sklonost navedenog upitnika da precjenjuje stvarnu razinu tjelesne aktivnosti. Naši ispitanici pokazuju prosječno 5 sati sjedenja dnevno, što je relativno niže u usporedbi s općom populacijom, ali i dalje naglašava potrebu za dodatnim smanjenjem sjedilačkog vremena (14).

Sveukupno, ispitanici se mogu smatrati visoko tjelesno aktivnima, pri čemu najveći doprinos ukupnoj aktivnosti daju hodanje i aktivnosti umjerenog intenziteta, dok je intenzivna tjelesna aktivnost prisutna u manjem opsegu. Istodobno, prisutno sjedilačko ponašanje ukazuje na potrebu za dodatnim intervencijama usmjerenima na smanjenje vremena provedenog u sjedećem položaju.

Rezultati ovog istraživanja imaju određena ograničenja. Podaci su prikupljeni primjenom upitnika samoprocjene (postoji mogućnost sustavnog odstupanja u procjeni razine tjelesne aktivnosti i sjedilačkog ponašanja), što može dovesti do precjenjivanja ili podcjenjivanja stvarne razine tjelesne aktivnosti ispitanika. Nadalje, uzorak je bio relativno malen i pretežno ženskog spola, što može ograničiti mogućnost generalizacije dobivenih rezultata na populaciju svih fizioterapeuta u Republici Hrvatskoj. Također, zbog presječnog dizajna istraživanja nije moguće utvrditi uzročno-posljedične odnose između promatranih varijabli.

Unatoč navedenim ograničenjima, istraživanje ima nekoliko važnih prednosti. Usmjereno je na fizioterapeute, profesionalnu skupinu koja ima značajnu ulogu u promicanju tjelesne aktivnosti i zdravih životnih navika u općoj populaciji. Dodatno, za procjenu razine tjelesne aktivnosti korišten je IPAQ-SF, međunarodno prihvaćen i validiran instrument koji omogućuje usporedbu rezultata s drugim istraživanjima.

Buduća istraživanja trebala bi uključiti veći i reprezentativniji uzorak fizioterapeuta te, uz subjektivne metode procjene, primijeniti i objektivne metode mjerenja tjelesne aktivnosti (npr. akcelerometriju) kako bi se dobio precizniji uvid u njihove obrasce kretanja i sjedilačkog ponašanja. Preporučuje se uključivanje longitudinalnih dizajna zbog praćenja promjena u obrascima aktivnosti kroz vrijeme te bolju interpretaciju njihovih zdravstvenih implikacija.

ZAKLJUČAK

Ispitanici se mogu smatrati relativno visoko tjelesno aktivnom skupinom jer redovito sudjeluju u različitim oblicima kretanja, posebno u hodaњу i umjerenoj tjelesnoj aktivnosti, no postoji prostor za unaprjeđenje - prvenstveno u smanjenju vremena provedenog sjedeći te u uključivanju više intenzivne tjelesne aktivnosti u svakodnevicu. Buduća istraživanja trebala bi ispitati postoje li slični obrasci u drugim regijama te jesu li aktivniji fizioterapeuti ujedno i učinkovitiji u promicanju zdravih životnih navika. Kako bi se ustanovilo ostvaruju li fizioterapeuti razinu tjelesne aktivnosti za koju vjeruju da je postižu, ubuduće bi se, uz samoprocjenu, trebala uključiti i objektivna mjerenja tjelesne aktivnosti.

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EXPLORING SEASONAL AND ORGANISATIONAL DETERMINANTS OF INJURY RECURRENCE AND BURDEN IN CROATIAN FOOTBALL AND HANDBALL

Utjecaj sezonskih i organizacijskih čimbenika na ponavljanje ozljeda i opterećenje ozljedama u hrvatskom nogometu i rukometu

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ABSTRACT

Background: Sports injuries challenge team sports by affecting athletes' availability and training. Seasonal and organisational factors may influence the occurrence, recurrence, and cumulative burden of injury. The aim of this paper is to explore the association between seasonal and organisational factors and injury recurrence and burden among Croatian male football and handball players.

Methods: This secondary exploratory analysis included 203 male athletes (114 football players and 89 handball players) competing in national leagues. Analysed variables included sport type, training volume, season phase, and access to a club physiotherapist. Associations between season phase and injury were analysed using chi-square tests; odds ratios (ORs) and relative risks (RRs) were estimated to explore links between organisational factors and recurrent injuries.

Results: Injuries occurred more frequently during the competitive phase of the season (58.9%) compared with the preparatory phase (41.1%) ($\chi^2(1)=10.68$, $p=0.001$, $OR\approx 2.05$). Teams with access to a physiotherapist reported fewer recurrent injuries (43.9%) compared with teams without physiotherapy support (60.0%), corresponding to a 27% lower relative risk ($RR=0.73$), although the difference did not reach statistical significance. The estimated injury burden ranged between 7 and 11 lost weeks of training or competition per athlete annually, corresponding to approximately 15–20% of a standard competitive season.

Conclusion: The findings suggest that the competitive phase of the season may be associated with increased injury risk, while regular physiotherapy support may contribute to reducing injury recurrence and cumulative absence from sport. Continuous physiotherapy involvement, workload monitoring, and structured injury surveillance may be important for maintaining athlete health and season availability.

Keywords: Soccer; Handball; Athletic Injuries; Physical Therapy Modalities; Rehabilitation

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SAŽETAK

Uvod: Sportske ozljede predstavljaju izazov u ekipnim sportovima jer utječu na dostupnost sportaša i kontinuitet treninga. Sezonski i organizacijski čimbenici mogu utjecati na pojavnost, ponavljanje i ukupno opterećenje ozljedama. Cilj ovog rada je istražiti povezanost sezonskih i organizacijskih čimbenika s ponovnim ozljedama i opterećenjem ozljedama kod hrvatskih nogometaša i rukometaša.

Metode: Ova sekundarna eksplorativna analiza uključila je 203 muška sportaša (114 nogometaša i 89 rukometaša) koji su se natjecali u nacionalnim ligama. Analizirani su vrsta sporta, volumen treninga, faza sezone i dostupnost klupskog fizioterapeuta. Povezanost između faze sezone i ozljeda analizirana je hi-kvadrat testom, dok su omjer izgleda (OR) i relativni rizik (RR) korišteni za procjenu povezanosti organizacijskih čimbenika i ponovnih ozljeda.

Rezultati: Ozljede su se češće javljale tijekom natjecateljske faze sezone (58.9%) u odnosu na pripremno razdoblje (41.1%) ($\chi^2(1)=10.68$, $p=0.001$, $OR\approx 2.05$). Momčadi s fizioterapeutom imale su manji udio ponovnih ozljeda (43.9%) u usporedbi s momčadima bez fizioterapeutske podrške (60.0%), što odgovara 27% nižem relativnom riziku ($RR=0.73$), iako razlika nije bila statistički značajna. Procijenjeno opterećenje ozljedama iznosilo je između 7 i 11 izgubljenih tjedana treninga ili natjecanja po sportašu godišnje, što odgovara približno 15–20% standardne natjecateljske sezone.

Zaključak: Nalazi upućuju na to da bi natjecateljska faza sezone mogla biti povezana s povećanim rizikom od ozljeda, dok bi kontinuirana fizioterapeutska podrška mogla doprinijeti smanjenju ponovnih ozljeda i ukupnog izbjivanja iz sporta. Kontinuirano uključivanje fizioterapeuta, praćenje opterećenja i strukturirani sustavi nadzora ozljeda mogu biti važni za očuvanje zdravlja sportaša i njihove dostupnosti tijekom sezone.

Ključne riječi: nogomet; rukomet; sportske ozljede; fizioterapijske metode; rehabilitacija



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INTRODUCTION

Football and handball are contact team sports that require repeated high-intensity actions such as accelerations, decelerations, jumps, and abrupt changes of direction (1–3). These dynamic, repetitive movements, combined with frequent player-to-player contact, make both sports highly susceptible to musculoskeletal injuries. At professional and semi-professional levels, dense match schedules and heavy training loads can reduce recovery opportunities and elevate injury risk despite the recognised health benefits of regular physical activity (4).

Epidemiological evidence shows that contact team sports have higher injury incidence than non-contact individual sports, averaging about 2.6 injuries per 1000 hours of exposure (5). In football, muscle injuries account for approximately one-third of all cases, with about 92% affecting the lower limbs; reported rates increase from 3.7 injuries per 1000 hours during training to more than 30 per 1000 hours in competition (6,7). Recent data indicate that the overall incidence of injuries in professional male football players is approximately 7.75 ± 2.28 injuries per 1000 hours of exposure, while that of amateur players is 7.98 ± 2.95 injuries per 1000 hours. The incidence of match injuries (30.64 ± 10.28 injuries/1000 h) is about 7.7 times higher than training injury rates (3.97 ± 1.35

injuries/1000 h) in professionals and 5.5 times higher in amateurs (17.56 ± 6.15 vs. 3.22 ± 1.40 injuries/1000 h) (8). Aggregate lower-extremity injuries predominate in both groups, accounting for about 83% in professionals and 80% in amateurs, with the thigh, ankle, and knee being the most frequently affected sites. Handball demonstrates a similarly high injury incidence, ranging from 0.9 to 2.6 per 1000 training hours and 9.9 to 41 per 1000 competition hours (9–11). High injury rates are consistently observed across professional, amateur, and youth levels, both in training and match play (6,7,11). Increasing competitive demands, speed, and training intensity further contribute to this trend (12). Musculoskeletal injuries account for approximately 80% of football injuries and about 67% of handball injuries, with the remainder involving other body systems (13,14).

Beyond these sport-specific patterns, injury occurrence and recurrence in team sports are influenced by multiple contextual and organisational factors, including training load, competition phase, and the quality of healthcare support (12). Seasonal variation, typically a higher incidence during the competitive phase, reflects fluctuations in physical and psychological stress, while consistent physiotherapy involvement may enhance rehabilitation

and reduce time loss. Examining these seasonal and organisational determinants provides essential insight for mitigating injury recurrence and overall burden, particularly within smaller national contexts such as Croatia.

Building on previous findings (15), this study examined how seasonal and organisational factors are associated with injury recurrence and burden among Croatian male football and handball players. The following hypotheses were formulated: (H1) injuries would occur more frequently during the competitive phase than during the preparatory phase of the season, (H2) clubs employing a physiotherapist would show lower injury recurrence rates than those without one, and (H3) teams with a physiotherapist would have a smaller overall injury burden, expressed as the total number of time-loss weeks per athlete.

METHODS

This study represents an exploratory secondary analysis of data previously collected and published by Gosić et al. (15). The original research was a cross-sectional study designed to describe the prevalence, localisation, and contributing factors of musculoskeletal injuries among Croatian male football and handball players. The current analysis employed a more focused approach to explore the associations among seasonal phase, organisational support, and injury burden. The reporting of this analysis followed the general principles of the STROBE statement for cross-sectional studies (16).

All procedures of the primary study complied with the ethical principles outlined in the Declaration of Helsinki (17) and were approved by the institutional Ethics Committee for Biomedical Research at the Faculty of Health Studies, University of Rijeka. Participation was voluntary, and all respondents provided informed consent prior to completing the survey. Permission to conduct a secondary analysis of the anonymised dataset was obtained from the authors of the original publication (15).

The dataset included 203 male athletes (114 football players and 89 handball players) competing in national-level Croatian leagues. Eligibility criteria comprised: (a) age ≥ 18 years; (b) continuous training and competition participation within the previous 12 months; and (c) absence of acute illness or neurological disorders. Players who failed to complete essential injury-related questions were excluded. Data were collected via an anonymous, self-administered online questionnaire distributed through clubs and team staff, as described by Gosić et al. (15).

Variables were selected from the original dataset and grouped into four domains: demographic, training, organisational, and injury-related characteristics. Demographic variables included age and sport type (football or handball). Training variables comprised weekly training frequency, average session duration, and the rest period between sessions (in hours). The key organisational variable was the presence of a club physiotherapist, coded as yes or no. Seasonal factors were represented by the season phase at the time of injury, classified as preparatory or competitive.

Injury-related variables included lifetime injury occurrence (yes/no), reinjury (yes/no), and injury mechanism, dichotomised as contact or non-contact. In addition, the duration of absence (weeks) was recorded as a continuous measure to estimate the cumulative injury burden, representing the total time lost per athlete. An injury was defined as any musculoskeletal complaint sustained during sports activity that resulted in at least one day of restricted participation, consistent with international consensus definitions for injury surveillance in team sports (18). Re-injury was defined as a subsequent occurrence of the same or a similar injury at the same anatomical site following a full return to participation (19).

Descriptive statistics (mean, standard deviation, and proportions) were calculated for all variables. Group comparisons were performed using Pearson's chi-square (χ^2) test of independence to examine associations between categorical variables, such as season phase and injury occurrence or physiotherapist presence and re-injury rate. Effect sizes were quantified using Cramér's V , while relative risk (RR) and odds ratio (OR) were calculated to estimate the magnitude and direction of associations (20,21). Injury burden was derived by combining lifetime injury prevalence with the mean and median absence duration, providing an approximate indicator of cumulative time loss per athlete. Non-parametric correlations (Spearman's ρ) were used to explore relationships between continuous variables. A significance level of $p < 0.05$ was applied throughout, in line with conventional statistical practice (22). Analyses were based on complete cases (pairwise deletion) to account for item-level missing data. Graphical visualisations were produced to complement statistical analyses and to illustrate key effect-size estimates (RR, OR) and injury burden.

Data analyses were performed using Microsoft Excel and Jeffreys's Amazing Statistics Program (JASP) software (version 0.95.4, JASP Team, University of Amsterdam), using a two-tailed significance level of $p < 0.05$.

RESULTS

Participant characteristics

The sample (Table 1) consisted predominantly of young adult male athletes with comparable anthropometric and training characteristics across sports. Most participants (78.3%) had ≥ 9 years of competitive experience, reflecting an experienced sub-elite population. Average training volume was about 5 sessions per week, each lasting approximately 2.5 hours, with about 17 hours of recovery between sessions. Among athletes with a history of injury ($n=176$), 79% reported having access to a club physiotherapist, providing an appropriate organisational context for subsequent analyses.

Descriptive data derived from the original dataset (15). Minor rounding differences arise from secondary data processing and subgroup trimming to ensure complete cases. The variable “club physiotherapist present” refers

to injured athletes only ($n = 176$).

Seasonal patterns of injury

As seen in Table 2, injuries occurred more frequently during the competitive phase (106/180; 58.9%) than during the preparatory phase (74/180; 41.1%), $\chi^2(1)=10.68$, $p=0.001$, Cramér's $V=0.24$. The relative risk of sustaining an injury during competition was 1.43 (95% CI 1.15–1.77), and the odds ratio was 2.05 (95% CI 1.33–3.15), indicating a small-to-moderate association between season phase and injury occurrence. Contact injuries (99/181; 54.7%) were more frequent than non-contact injuries (82/181; 45.3%), but this difference was not statistically significant, $\chi^2(1)=2.83$, $p=0.093$ (RR = 1.21, 95% CI 0.96–1.53; OR = 1.46, 95% CI 0.94–2.27).

Valid cases: $n = 180$ for season phase and $n = 181$ for injury

Variable	Total	Football	Handball
Participants (n, %)	203 (100)	114 (56.2)	89 (43.8)
Age (years; M $\pm$ SD)	24.7 $\pm$ 4.8	25.1 $\pm$ 4.6	24.2 $\pm$ 5.1
Height (cm)	182.3 $\pm$ 6.7	182.9 $\pm$ 6.3	181.6 $\pm$ 7.2
Body mass (kg)	80.2 $\pm$ 7.9	81.1 $\pm$ 7.5	78.9 $\pm$ 8.2
BMI (kg/m ²)	24.1 $\pm$ 1.9	24.2 $\pm$ 1.8	24.0 $\pm$ 2.0
≥ 9 years of sport experience (%)	78.3	79.1	77.3
Weekly training frequency (sessions/week)	5.25 $\pm$ 1.1	5.31 $\pm$ 1.0	5.18 $\pm$ 1.2
Session duration (hours)	2.46 $\pm$ 0.73	2.48 $\pm$ 0.71	2.43 $\pm$ 0.75
Rest between sessions (hours)	16.9 $\pm$ 2.5	16.8 $\pm$ 2.6	17.0 $\pm$ 2.4
History of injury during career (n, %)	176 (86.7)		
Club physiotherapist present (n, %)	139 (79.0)		

Table 1. Participant characteristics (N = 203)

Variable	n/N	%	χ^2 (df)	p value	Cramér's V	RR (95 % CI)	OR (95 % CI)
Season phase							
Competitive	106/180	58.9	10.68 (1)	0.001 **	0.24	1.43 (1.15 – 1.77)	2.05 (1.33 – 3.15)
Preparatory (ref.)	74/180	41.1	–	–	–	1.00 (ref.)	1.00 (ref.)
Injury mechanism							
Contact	99/181	54.7	2.83 (1)	0.093	0.13	1.21 (0.96 – 1.53)	1.46 (0.94 – 2.27)
Non-contact (ref.)	82/181	45.3	–	–	–	1.00 (ref.)	1.00 (ref.)

Table 2. Distribution of injuries by season phase and injury mechanism

mechanism. Data were analysed using Pearson's χ^2 test of independence, with Cramér's V reported as a measure of effect size. Relative risks (RR) and odds ratios (OR) with 95 % confidence intervals were derived from aggregated proportions using Woolf's method (Altman, 1990). Effect size interpretation followed Cohen's (1988) thresholds. Exposure-standardised incidence rates were not available. Significance level: ** $p < 0.01$.

Organisational factors and re-injury

Athletes whose clubs employed a physiotherapist reported fewer re-injuries (43.9%) compared with those without such support (60.0%), corresponding to a 27% reduction in relative risk (RR=0.73) and nearly half the odds of recurrence (OR=0.52; 95% CI 0.25–1.07) (Table 3). Although not statistically significant, the magnitude and direction of the association may suggest a potentially beneficial effect of integrated physiotherapy support.

Valid $n = 179$ represents athletes with complete data for both variables (physiotherapist presence and re-injury status). Data were analysed using Pearson's χ^2 test of independence, with Cramér's V reported as a measure of effect size. Relative risk (RR) and odds ratio (OR) with 95% confidence intervals (CI) were calculated from 2x2 contingency data using Woolf's method (Altman, 1990). Effect size interpretation followed Cohen's (1988) thresholds ($V \geq 0.10$ = small, $V \geq 0.30$ = medium). Statistical significance was set at $p < 0.05$. PT = physiotherapist; RI = re-injury; df = degrees of freedom; RR = relative risk; OR = odds ratio; CI = confidence interval.

Injury burden

As seen in Table 4, each athlete lost an estimated 7–11 weeks of training or competition time due to injury, representing approximately 15–20% of a standard 52-week training year. The lifetime injury prevalence of 86.7%, combined with an average absence duration of 12.3 weeks, indicates that injuries impose a substantial cumulative time-loss burden. The difference between the median (8.7 weeks) and mean (12.3 weeks) suggests that a smaller subgroup of athletes experienced extended absences, indicating a right-skewed distribution of absence durations driven by severe or recurrent injuries.

DISCUSSION

This secondary analysis examined how seasonal and organisational factors relate to injury recurrence and burden in Croatian football and handball players. Injuries occurred significantly more often during the competitive phase (58.9% vs 41.1%; $\chi^2(1)=10.68$, $p=0.001$), corresponding to a roughly 40% higher relative risk compared with the preparatory phase. The strength of this association indicates that competitive periods are the most vulnerable time for injury occurrence, particularly in sub-elite settings where recovery may be inconsistent. The difference between contact and non-contact injuries (54.7% vs. 45.3%) did not reach statistical significance ($p=0.093$), suggesting that both mechanisms contribute comparably to the overall injury burden. Athletes whose teams employed a physiotherapist reported fewer re-injuries (43.9% vs. 60.0%), corresponding to a 27% lower relative risk, although this trend was not statistically significant.

PT	RI Yes	RI No	Total n	% RI	χ^2 (df)	p value	Cramér's V	RR (95 % CI)	OR (95 % CI)
Present	61	78	139	43.9	3.23 (1)	0.072	0.13	0.73 (0.49–1.09)	0.52 (0.25–1.07)
Absent (ref.)	24	16	40	60.0	–	–	–	1.00 (ref.)	1.00 (ref.)

Table 3. Re-injury rates by the presence or absence of a club physiotherapist

Indicator	Value
Lifetime injury prevalence	176/203 = 86.7%
Absence duration (weeks)	Median = 8.7; Mean = 12.28
Estimated lost weeks per athlete (median-based)	~ 7.5
Estimated lost weeks per athlete (mean-based)	~ 10.6

Table 4. Estimated injury burden expressed as total time-loss (weeks)

Derived by combining overall injury prevalence and absence duration. Multiple injuries per athlete were not considered.

Still, it indicates a potential benefit of structured physiotherapy support for safer recovery and reduced time loss. The estimated injury burden of about 7–11 weeks per athlete per year, roughly one-fifth of a competitive season, illustrates the substantial functional cost of musculoskeletal injuries in Croatian team sports. These findings extend previous observations (15) by identifying when injuries are most likely to occur and the organisational conditions under which their long-term impact may be mitigated.

The present secondary analysis identified a significantly higher incidence of injuries during the competitive phase, confirming that this period is the most vulnerable stage of the season for football and handball players. Similar trends have been reported internationally, where the intensity, match congestion, and psychological pressure of competition are recognised as major contributors to increased injury risk (6,23,24). The observed 40% higher relative risk during competitive play aligns with this evidence, emphasising the need for targeted load management and adequate recovery strategies during peak match periods. The absence of a significant relationship between rest duration and injury frequency in our data further supports the multifactorial nature of injury risk. As suggested by Gabbett (23) and Meeusen et al. (24), recovery time alone does not capture the complex interactions among physiological load, neuromuscular fatigue, and psychological stress.

Although not statistically significant, the observed reduction in re-injury rates may indicate a potentially beneficial effect of physiotherapy support. This finding aligns with evidence from controlled trials demonstrating that structured physiotherapy and strength-training programs can significantly decrease the likelihood of recurrent injuries (25,26). In the context of Croatian team sports, where around one-fifth of athletes lack direct access to physiotherapy services (15), this organisational disparity could represent a modifiable risk factor. The importance of such professional medical support has been repeatedly highlighted in European surveillance frameworks promoting standardised injury- and illness-monitoring systems (27).

The estimated injury burden of 7–11 lost weeks per athlete per year, equivalent to approximately 15–20% of a competitive season, illustrates the substantial performance and welfare cost of musculoskeletal injuries in sub-elite contexts. However, because multiple injuries per athlete were not accounted for, these estimates should be interpreted as approximate indicators of injury burden rather than precise cumulative burden measures. Comparable time-loss patterns have been documented in European football and handball studies (28–30). These consistent findings highlight the shared biomechanical and contextual challenges of high-intensity team sports,

where cumulative exposure, competition schedules, and recovery constraints jointly shape injury outcomes. To mitigate these effects, comprehensive surveillance systems that integrate medical, training, and workload data are essential for evidence-based prevention and optimal athlete availability throughout the season.

From a national perspective on sports health, the findings highlight the potential importance of physiotherapy availability across competitive levels in Croatia. The present findings support further evaluation of broader physiotherapy availability and its potential role in reducing injury recurrence. Establishing a national injury surveillance registry would enable systematic monitoring and guide evidence-based prevention strategies across sports disciplines. Moreover, given that this study focused exclusively on male athletes, future research should address potential sex-based differences in injury mechanisms, recurrence, and rehabilitation outcomes among female players, who remain underrepresented in Croatian sports medicine research.

This exploratory secondary analysis expands on the original dataset by examining when and under what organisational conditions injuries occur. Unlike the primary study, which focused on injury frequency and location, this work analyzed associations between seasonal phases, physiotherapy support, and injury recurrence, including effect sizes via relative risks, odds ratios, and Cramér's V. It also introduced injury burden as total time-loss per athlete, offering a practical measure of functional impact. By combining organisational and temporal factors, the analysis provides a context-specific understanding of injury determinants in Croatian team sports.

As a secondary analysis, this study was constrained by the structure of the original dataset, which limited control over potential confounders and unmeasured variables such as injury type or severity. Exposure time was not standardised, preventing the calculation of incidence rates per 1000 hours of participation; therefore, the reported relative risks and odds ratios should be interpreted as measures of association based on injury distributions rather than true exposure-adjusted injury risks. The sample included athletes from different teams and competitive levels, introducing contextual variability in medical support and training load. Self-reported data may also have been affected by recall bias, which may have influenced estimates of injury frequency and time loss. The analysis was restricted to bivariate associations, as sample size did not permit multivariate modelling.

Future research should use prospective designs with systematic exposure tracking (like GPS and recovery indices) to clarify causal relationships. Larger samples would allow multivariate analyses of seasonal, organisational, and individual factors. Longitudinal studies on physiotherapy and strength-based prevention could assess

their effectiveness. A national injury surveillance system for team sports would support ongoing monitoring and prevention planning.

CONCLUSION

The findings of this exploratory analysis suggest that injuries in team sports may occur more frequently during the competitive phase of the season and that continuous physiotherapy support may contribute to lower injury recurrence and reduced time loss. The results additionally indicate a possible influence of seasonal workload and organisational factors on injury patterns among Croatian football and handball players. Continuous physiotherapy involvement, workload monitoring, and structured injury surveillance may be important components in maintaining athlete health and season availability.

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EVALUATION OF RECOVERY FACTORS IN INDIVIDUALS WITH CHRONIC LOW BACK PAIN

Procjena čimbenika oporavka u osoba s kroničnom križoboljom

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ABSTRACT

Background: Chronic low back pain is a complex biopsychosocial condition in which psychological and social factors, alongside biological factors, play an important role in its development and persistence of chronic low back pain. Accordingly, contemporary clinical practice guidelines recommend adopting a biopsychosocial approach and assessing the flag system to identify factors that may influence the course of the condition and treatment outcomes. However, despite these recommendations, the assessment of psychosocial factors in physiotherapy practice remains limited, partly due to insufficient education and training of physiotherapists in the biopsychosocial approach.

Methods: This conceptual paper is based on a review of the available scientific and professional literature, as well as the authors' clinical experience, with the aim of presenting the biopsychosocial model of pain and the assessment of psychosocial factors in individuals with chronic low back pain. Clinical practice guidelines on the assessment of flags and their application in physiotherapy practice were analysed, and the findings are presented through a conceptual analysis of the available literature.

Results: Analysis of clinical guidelines for the management of low back pain showed that most guidelines recommend the assessment of psychosocial factors in individuals with chronic low back pain, most commonly through the concept of yellow flags. The most frequently highlighted factors include symptoms of depression, negative beliefs about pain, and a passive role of the patient in rehabilitation. Most guidelines recommend assessing psychosocial factors at the beginning of treatment and in cases of delayed recovery, using standardized assessment tools.

Conclusion: Chronic low back pain is a complex condition involving interactions between physical, psychological, behavioral, and social factors; therefore, the biopsychosocial model represents the most appropriate framework for its assessment and management. Despite the clear influence of psychosocial factors on recovery outcomes, they remain insufficiently incorporated into routine clinical assessment and therapeutic decision-making. Further education of clinicians is needed to enable effective use of psychosocial assessment tools and their integration into individualized treatment decisions for individuals with chronic low back pain.

Keywords: chronic low back pain; biopsychosocial model; yellow flags; psychosocial factors; physiotherapy assessment

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SAŽETAK

Uvod: Kronična lumbalna bol složeno je biopsihosocijalno stanje u čijem nastanku i održavanju, uz biološke, važnu ulogu imaju psihološki i socijalni čimbenici. Stoga suvremene kliničke smjernice preporučuju biopsihosocijalni pristup i procjenu sustava zastavica radi prepoznavanja čimbenika koji mogu utjecati na tijek i ishode liječenja kronične križobolje. Međutim, unatoč tim preporukama, procjena psihosocijalnih čimbenika u fizioterapijskoj praksi i dalje je nedostatna, dijelom zbog ograničene edukacije fizioterapeuta u području biopsihosocijalnog pristupa.

Metode: Ovaj konceptualni rad temelji se na pregledu znanstvene i stručne literature te kliničkom iskustvu autora, s ciljem prikaza biopsihosocijalnog modela boli i procjene psihosocijalnih čimbenika kod osoba s kroničnom križoboljom. Analizirane su kliničke smjernice za procjenu zastavica i njihove primjene u fizioterapijskoj praksi, a spoznaje su prikazane kroz konceptualnu analizu dostupne literature.

Rezultati: Analiza kliničkih smjernica za liječenje križbolje pokazala je da većina preporučuje procjenu psihosocijalnih čimbenika u osoba s kroničnom križoboljom, najčešće kroz koncept žutih zastavica. Najčešće istaknuti čimbenici uključuju simptome depresije, negativna uvjerenja o boli i pasivnu ulogu pacijenta u rehabilitaciji. Većina smjernica preporučuje procjenu psihosocijalnih čimbenika na početku liječenja i pri sporijem oporavku, koristeći standardizirane alate

Zaključak: Kronična lumbalna bol predstavlja složeno stanje u kojem međudjeluju fizički, psihološki, bihevioralni i socijalni čimbenici, zbog čega biopsihosocijalni model predstavlja najprikladniji okvir za njezinu procjenu i liječenje. Unatoč jasnom utjecaju psihosocijalnih čimbenika na tijek i ishod oporavka, oni se i dalje nedovoljno uključuju u rutinsku kliničku procjenu i terapijsko odlučivanje. Stoga je potrebna dodatna edukacija kliničara kako bi se alati za procjenu psihosocijalnih čimbenika učinkovito primjenjivali i koristili u donošenju individualiziranih odluka o liječenju kronične križobolje.

Ključne riječi: kronična križobolja; biopsihosocijalni model; žute zastavice; psihosocijalni čimbenici; fizioterapijska procjena



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INTRODUCTION

Chronic low back pain is a complex, multifactorial condition with a high prevalence that can lead to disability and functional impairment. It is described as a personal experience shaped by and grounded in an individual's life experiences. The revised definition of pain by the International Association for the Study of Pain (IASP) states that pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage." The fact that even a potential tissue damage is also a component of an individual's pain experience explains how non-mechanical factors can influence the experience, progression, and persistence of pain, inactivity, depression, disability, and, consequently, functional impairment (1–3).

Reduced movement leads to decreased pain, which may further reinforce erroneous and potentially harmful pain-related beliefs such as catastrophizing, fear of movement, and avoidance (the belief that normal movements will cause pain), as well as psychological distress. Psychological distress has been shown to have a bidirecti-

onal relationship with pain, contributing to a markedly negative perception of the pain experience. Psychiatric conditions such as clinical depression are also causally associated with pain perception (4–6).

Since the biopsychosocial approach views pain as the result of interactions among multiple factors rather than solely as a consequence of structural damage, this paper emphasizes assessment through the flag system, which represents prognostic risk factors: psychological factors ("yellow flags"), perceptions of the relationship between work and health ("blue flags"), systemic or contextual barriers ("black flags"), psychiatric symptoms ("orange flags"), and potential indicators of spinal pathology requiring urgent specialist evaluation ("red flags") (2,7).

Although clinical guidelines recommend adopting the biopsychosocial model and assessing psychosocial factors as determinants of recovery in individuals with chronic low back pain, their implementation in physiot-

herapy practice remains insufficient. This is partly due to the limited education of physiotherapists in the biopsychosocial approach, resulting in psychosocial assessment often being omitted despite its importance for planning individualized interventions. Therefore, the aim of this paper was to present the theoretical foundation of the biopsychosocial model, as well as the concept of psychosocial factor assessment.

METHODS

This conceptual paper is based on a review of the available scientific and professional literature, as well as on the authors' experiential knowledge gained through professional practice in the field. Scientific and professional literature examining the biopsychosocial model of pain and the importance of psychosocial factors in the assessment of individuals with chronic low back pain was reviewed. The purpose of the literature search was to present the theoretical framework of the biopsychosocial model and to describe potential approaches to the assessment of psychosocial factors. The assessment concept was developed based on the reviewed literature and the authors' clinical experience. Particular attention was paid to the analysis of available clinical practice guidelines for the management of low back pain.

During the review of the available clinical guidelines, the types of flags assessed by individual guidelines were examined. In addition, the assessment methods recommended by these guidelines were analyzed. Particular emphasis was placed on comparing the recommendations of different guidelines regarding the assessment of the various flag categories, as well as on the feasibility of their implementation in physiotherapy assessment. Since this paper does not constitute original research, the findings are not presented through statistical analyses but rather through a conceptual analysis and interpretation of the available evidence.

The literature search was conducted using the PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar databases. The search strategy employed keywords combined with the Boolean operators AND, OR, and NOT, including: "chronic low back pain" AND "psychosocial factors", "chronic low back pain" AND "biopsychosocial model", "chronic low back pain" AND "yellow flags", ("chronic low back pain" OR "low back pain") AND ("fear avoidance" OR "kinesiophobia" OR "pain catastrophizing"), ("chronic low back pain" OR "low back pain") AND ("psychosocial factors") AND ("assessment" OR "evaluation"), and "low back pain" AND "clinical guidelines".

THEORETICAL FRAMEWORK OF THE FLAG SYSTEM WITHIN THE BIOPSYCHOSOCIAL MODEL

Biopsychosocial Model and Chronic Pain

The biomedical and biopsychosocial models represent two distinct approaches to understanding health and disease. The biopsychosocial model was developed to broaden the narrow focus of the biomedical model, which remains the dominant approach to assessment and treatment in Western healthcare (including pain management). The biomedical model is primarily based on a structural conceptualization of pain. It aims to identify the source of pain (typically through diagnostic imaging), after which treatment is directed at the tissue identified as damaged. However, pain is often unrelated to pathoanatomical changes and represents a considerably more complex phenomenon involving additional factors that influence pain perception and experience. The reductionist assumptions underlying the biomedical model limit a holistic, multidimensional approach to assessment and treatment.

In contrast, the biopsychosocial model promotes a holistic perspective in healthcare by recognizing that, in addition to biological factors contributing to pain and disease, psychological and social influences also play a central role. One of the challenges associated with implementing the biopsychosocial model is the difficulty healthcare professionals encounter when assessing complex and multifactorial conditions (8,9).

The biopsychosocial model conceptualizes pain and disability as multidimensional, dynamic interactions among biological, psychological, and social factors that reciprocally influence one another (10-14) (Figure 1).

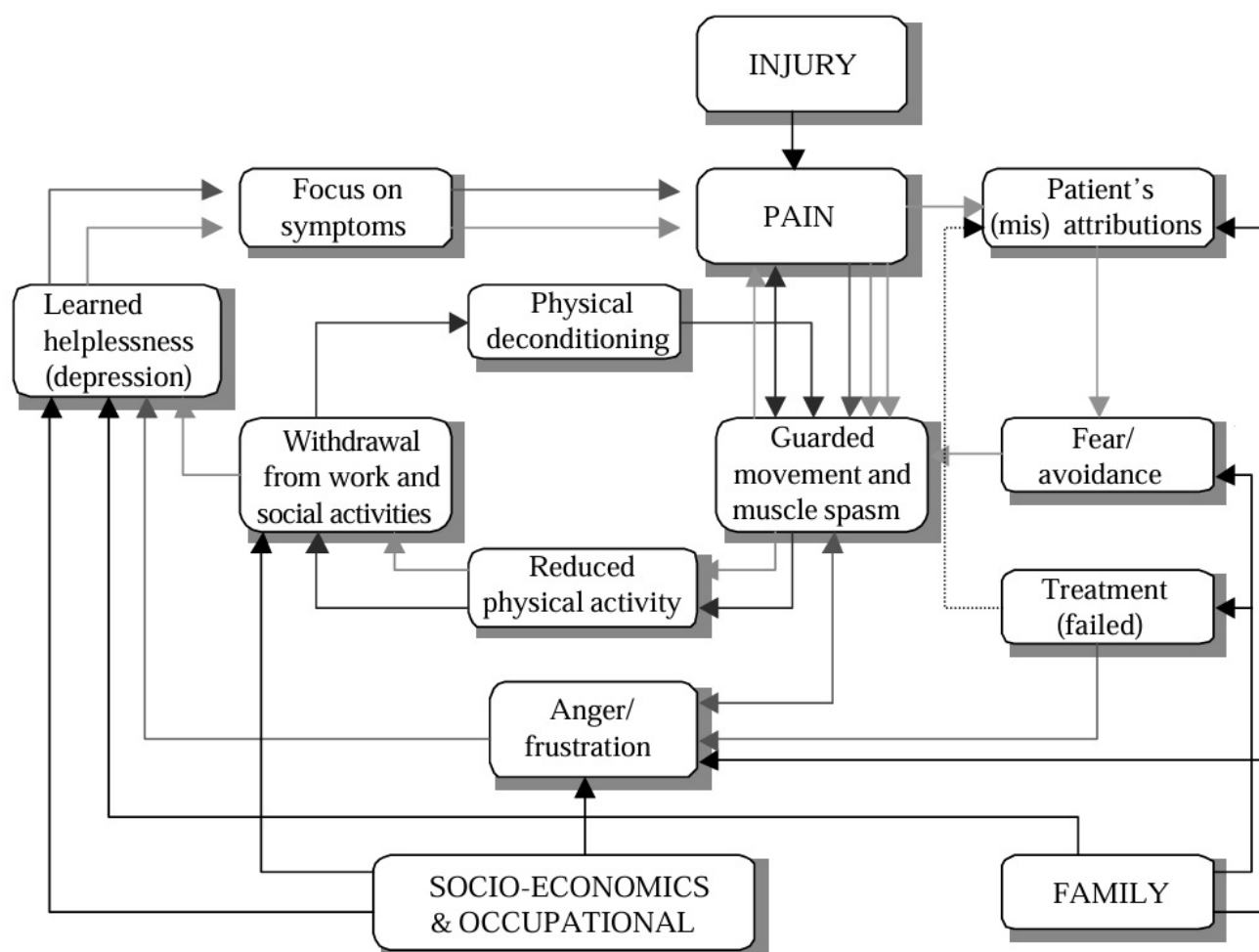


Figure 1. The biopsychosocial model and the influence of psychosocial factors (15)

Flag System

The flag system is a clinical framework used in the assessment of patients, particularly those with musculo-skeletal disorders such as chronic low back pain, to identify factors that may influence diagnosis, prognosis, and the selection of appropriate interventions.

The flag system helps distinguish pathological conditions requiring further diagnostic investigation or urgent medical intervention from psychological, social, and occupational factors that may contribute to the development or persistence of pain.

Flags can be classified into two main categories: clinical flags (red and orange) and psychosocial flags (yellow, blue, and black) - Table 1.

Red flags refer to clinical features that assist in identifying potentially life-threatening conditions. These include tumors, infections, fractures, and neurological disorders. Screening is performed during history taking at the initial assessment and may be supplemented by specific physical examination tests. The presence of red

flags indicates the need to consider further diagnostic investigations and/or referral to an appropriate specialist. Clinical red flags include cauda equina syndrome, fever and unexplained weight loss, a history of cancer, bladder or bowel dysfunction, progressive neurological deficit, severe pain that does not subside and is particularly pronounced at night, and any recent trauma that may increase the likelihood of fracture (16,17). When a physiotherapist identifies a potential red flag during the physiotherapy assessment, the patient should be referred for further medical evaluation without initiating physiotherapy interventions.

Orange flags indicate the presence of more severe psychiatric disorders. They represent the psychological equivalent of red flags and may include conditions such as clinical depression, personality disorders, substance use disorders, and severe post-traumatic stress disorder. In these situations, management should involve a psychiatrist, while physiotherapy remains an integral component of a multidisciplinary approach (17).

Yellow flags refer to maladaptive thoughts, emotions, and behaviors that negatively affect the patient's recovery. These include unhelpful and limiting beliefs about pain, negative expectations regarding recovery, stress, worries, fears and fear-avoidance behaviors, anxiety, excessive reliance on passive treatments, anxious and depressive behavioral patterns, social withdrawal, kinesiophobia, and pain catastrophizing.

In contemporary clinical practice, greater emphasis should be placed on identifying yellow flags, as they play a significant role in predicting the transition from acute to chronic pain (7,17).

Blue flags relate to the relationship between work and health. They commonly include beliefs that work is too physically demanding or is likely to cause further injury, as well as perceptions that supervisors and colleagues do not provide adequate workplace support (7).

Black flags refer to systemic or contextual barriers, including legislative or compensation-related obstacles that limit opportunities for returning to work, conflicts with insurance personnel following an injury, excessive protectiveness by family members or healthcare providers, and physically demanding work with limited possibilities for workplace modification (7).

CONCEPT OF PSYCHOSOCIAL FACTOR ASSESSMENT

Numerous psychosocial factors may contribute to the development of persistent disability and emotional distress, making a comprehensive assessment of all such factors time-consuming. Before initiating the assessment, it is important to determine the duration of symptoms, as psychosocial factors are particularly pronounced in individuals with chronic conditions.

In the Republic of Croatia, a considerable proportion of patients with low back pain begin physiotherapy only after experiencing symptoms for an extended period of time. Specifically, several months often elapse between referral by a general practitioner and the commencement of physiotherapy treatment. Accordingly, it is reasonable to assume that the presence of psychosocial factors should be assessed at the initial physiotherapy evaluation in most patients entering the physiotherapy process.

However, given the large number of patients, an alternative approach may be to assess yellow flags in individuals who do not demonstrate significant improvements in pain intensity or functional status following one course of physiotherapy. Furthermore, certain statements made by individuals with low back pain may indicate the presence of psychosocial factors associated with a less favorable recovery trajectory and may serve as indicators for a more detailed assessment of these factors. Some of the most common statements are presented in **Table 2**.

PSYCHOSOCIAL FLAGS		
Yellow flags	Blue flags	Black flags
■ Kinesiophobia ■ Pain catastrophizing ■ Depressed mood ■ Anxious mood ■ Passive coping with pain ■ Low motivation ■ Poor treatment adherence ■ Social withdrawal ■ Negative expectations regarding rehabilitation outcomes ■ Avoidance behavior ■ Stress ■ Excessive focus on symptoms	■ Fear of returning to work ■ Beliefs that work is harmful ■ Low motivation to return to work ■ Perceived excessive physical demands at work ■ Perceived lack of workplace support ■ Low self-perceived work ability	■ High physical job demands ■ Administrative barriers ■ Inadequate working conditions ■ Lack of workplace accommodations ■ Organizational barriers in the workplace ■ Financial difficulties ■ Legal proceedings ■ Lack of employer support ■ Limited access to healthcare ■ Conflicts ■ Dissatisfaction

Table 1. Psychosocial flags

Physiotherapists' education regarding the importance of identifying psychosocial factors also plays a crucial role in this process. Physiotherapists with appropriate knowledge and training are expected to more readily identify patients at increased risk of developing chronic pain and to conduct a more comprehensive assessment of yellow flags in these individuals. Such an approach would facilitate the timely identification of risk factors and the planning of individualized interventions aimed at mitigating their impact.

Assessment of yellow flags can be conducted through a patient interview during routine history taking. An interview represents a simple and effective method for identifying psychosocial factors that may influence the course and outcome of rehabilitation. In addition to the interview, standardized questionnaires play an important role by enabling a more systematic and objective assessment of psychosocial factors associated with pain and recovery. Furthermore, to ensure a comprehensive assessment of psychosocial barriers, physiotherapists may use a combination of clinical interviews and standardized questionnaires.

Clinical Interview

The clinical interview is a simple and effective tool that enables the unobtrusive identification of psychosocial factors that may influence the course and success of recovery.

During the interview, the physiotherapist should attempt to guide the conversation according to the statements made by the patient. It is important to emphasize that the interview provides the physiotherapist with an excellent opportunity to positively influence the patient's existing beliefs and attitudes. At the same time, the physiotherapist should be careful not to validate or reinforce the patient's negative beliefs, as even seemingly trivial statements made by the physiotherapist may be misinterpreted.

During the interview, the physiotherapist seeks to gain insight into the patient's beliefs, habits, and underlying motivations that shape their behaviour. It is not sufficient merely to identify behavioural patterns that have developed as a consequence of pain; it is equally important to determine whether the patient is aware that these

Attitudes and beliefs about low back pain	Behaviors
■ "Nothing can help me." ■ "It will never get better." ■ "My MRI findings are very bad." ■ "I must not exercise as long as I have pain." ■ "As soon as the pain starts, I have to stop exercising." ■ "The pain could become worse at any moment."	■ "Every time I perform this exercise, I feel that my condition worsens over the following few days." ■ "I do not remember the exercises you showed me last time." ■ "On a scale from 0 to 10, my pain intensity is 11." ■ "I no longer feel confident performing normal activities." ■ "I do not see the point of exercising."
Workplace / finances	Diagnosis / rehabilitation
■ "I have many work obligations and do not have time to exercise." ■ "Due to being on sick leave, my income is too low and I cannot afford to be absent from work any longer." ■ "My workplace keeps calling me and asking when I will return."	■ "I was told that my disc has shifted." ■ "I was told that I should not stand or walk for long periods." ■ "So far, only ultrasound therapy has helped me." ■ "I have already undergone therapy, and nothing has improved."
Emotional and affective status	Family
■ "Nothing can help me." ■ "It will never get better." ■ "I no longer know what to do." ■ "I always think about someone I know whose condition never improved."	■ "No one at home understands how much pain I am in." ■ "I still have to do all the household chores." ■ "I have a sick family member whom I need to take care of."

Table 2. Statements made by individuals with low back pain that may indicate the presence of psychosocial barriers to recovery

patterns have developed and continue to be maintained as a result of their pain experience.

Furthermore, during the interview, the physiotherapist should aim to determine what information the patient has received about their condition to date and the extent to which they understand it. Misinterpretation of information or explanations provided by healthcare professionals is common and may result in an inappropriate coping strategies and ineffective attempts to manage low back pain. In this context, it is particularly important to assess the patient's understanding and interpretation of X-ray and MRI findings.

Since physiotherapists in public healthcare institutions in the Republic of Croatia typically see patients for a minimum of two consecutive weeks with daily attendance, the interview can be extended over several days, during which patients often begin to open up more spontaneously. It is important that physiotherapists are able to understand and recognise other psychosocial limitations, including those related to emotional distress, work, and the patient's family environment.

Standardized Questionnaires

Numerous standardized questionnaires are available for the assessment of psychosocial barriers, with the primary aim of providing a quick and practical means of identifying whether a patient demonstrates signs of these factors. These questionnaires may assess a variety of constructs, including pain catastrophizing, fear of movement, kinesiophobia, fear-avoidance behaviours, self-efficacy, anxiety and depression, beliefs about low back pain, and others.

Accordingly, a wide range of questionnaires is available, including the **Örebro Musculoskeletal Pain Screening Questionnaire**, STarT Back Screening Tool, Fear-Avoidance Beliefs Questionnaire, Tampa Scale of Kinesiophobia, Pain Catastrophizing Scale, and Pain Self-Efficacy Questionnaire, among others.

In general, higher total scores on these questionnaires indicate the presence of certain psychosocial risk factors. However, it is important to emphasize that questionnaire scores alone neither establish nor are capable of establishing a diagnosis such as kinesiophobia, catastrophizing etc. Each patient's underlying motivation is unique, and the reasons for avoiding movement may differ considerably between individuals. Consequently, questionnaire results should always be interpreted with caution. Rather than serving as diagnostic tools, these questionnaires should be used to identify individuals who may be at relatively greater risk of poorer physiotherapy outcomes.

It should also be noted that the majority of the questionnaires listed above have not been validated or culturally adapted for use in the Croatian-speaking population.

For these reasons, the use of standardized questionnaires should be complemented by a clinical interview, during which individual questionnaire items can be explored in greater depth and the factors contributing to higher overall scores can be identified. This approach allows the patient's beliefs, fears, attitudes, and emotions to be discussed while simultaneously providing an opportunity to positively influence them through conversation and support. Such an approach also provides a foundation for planning subsequent interventions targeting specific psychosocial barriers.

Combining the Clinical Interview and Standardized Questionnaires

The authors of this paper propose combining the use of the clinical interview with standardized questionnaires. This approach improves the accuracy of psychosocial assessment while reducing the likelihood of misinterpreting questionnaire items. Furthermore, once the standardized questionnaire has been completed, it becomes considerably easier to direct the clinical interview toward the items that emerged as particularly relevant during the assessment.

Combining these two assessment methods also creates the opportunity to integrate quantitative and qualitative data, thereby providing a strong foundation for conducting research and further advancing physiotherapy in the assessment of these phenomena. Nevertheless, this combined approach also has certain limitations. It requires substantial time and resources, both of which are often limited in departments of physical medicine and rehabilitation. In addition, modifications to the organization of clinical practice are frequently necessary to ensure adequate conditions for conducting a comprehensive assessment. Finally, this approach requires physiotherapists to possess a high level of knowledge regarding psychosocial factors so that they can select the most appropriate questionnaire, interpret its results correctly, and effectively integrate them into the clinical interview.

RESULTS

A review of the available clinical practice guidelines identified those that stand out due to both the strength of their recommendations and the recognition of physiotherapy community in their respective countries. All but one of the included guidelines describe psychosocial factors. These factors are most commonly referred to as yellow flags, encompassing psychological and/or systemic/contextual factors. The most frequently reported yellow

flags were symptoms of depression/emotional distress, negative beliefs about pain, and a passive role in the rehabilitation process.

Black flags are also described, primarily in relation to workplace conflicts, the inability to modify the work environment, and organizational barriers in the workplace. Among the selected guidelines, only those from Austria (18) and New Zealand (19) refer to blue flags, whereas orange flags are mentioned only in the guideline from Belgium (20).

With the exception of the United States guidelines (21), most guidelines recommend assessing psychosocial factors at the beginning of treatment as well as in cases of delayed or insufficient patient recovery. Recommended assessment tools include the STarT Back Screening Tool, the **Örebro Musculoskeletal Pain Screening Questionnaire**, and the Acute Low Back Pain Screening

Questionnaire (ALBPSQ), while some guidelines also recommend the use of a clinical interview and other standardized questionnaires.

A detailed overview of the flag system described in the selected clinical practice guidelines, together with their recommendations for assessment, is presented in **Table 3** (22).

DISCUSSION

Although the biopsychosocial model is considered the fundamental framework for the contemporary management of low back pain, its implementation in clinical practice remains insufficiently defined. The main limitations of this model include its broad conceptualization, lack of specificity, and limited applicability to routine clinical practice (29). Clinical practice guidelines for the

	Australia (23)	Austria (18)	Belgium (20)	EU (24,25)	Germany (26)	Netherlands (27)	New Zealand (19)	UK (28)	USA (21)
Yellow flags	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blue flags		✓	✓						
Black flags	✓	✓	✓	✓		✓	✓	✓	
Orange flags			✓						
Assessment of psychosocial factors at the beginning of treatment	✓	✓	✓	✓	✓	✓	✓	✓	✓
Assessment of psychosocial factors in the absence of improvement after several weeks		✓		✓	✓		✓		
STarT Back Screening Tool questionnaire	✓	✓	✓		✓	✓	✓	✓	
Örebro Musculoskeletal Pain Screening Questionnaire / Acute Low Back Pain Screening Questionnaire (ALBPSQ)	✓	✓	✓		✓		✓		
Any standardized questionnaire	✓	✓							
Clinical interview	✓								

Table 3. Overview of recommendations presented in the selected clinical practice guidelines

management of low back pain are generally based on the biopsychosocial model, and almost all recommend the assessment of psychosocial factors. However, they rarely and vaguely provide clinicians with specific guidance regarding which factors should be assessed, when they should be assessed, or how the findings should be interpreted.

Research indicates that physiotherapists are generally insufficiently trained to implement the biopsychosocial model in clinical practice (30). Although most recognize the importance of psychosocial factors, limited knowledge often restricts their ability to perform appropriate assessment and intervention (31). Therefore, the aim of this conceptual paper was to propose and partially describe a framework for identifying and assessing psychosocial factors in clinical practice. In addition, this paper represents an effort to influence those physiotherapists within our professional community whose clinical practice remains predominantly biomedical in orientation. Qualitative studies have shown that physiotherapists primarily focus on the mechanical and biomechanical aspects of low back pain (32), while cognitive, psychological, and social factors are only partially recognized. Furthermore, research suggests that many physiotherapists perceive the assessment of these factors as being outside their professional role and scope of competence. Consequently, patients with pronounced psychosocial characteristics may be incorrectly perceived as difficult or insufficiently motivated, rather than having their behavioural patterns understood as an integral component of the complex biopsychosocial mechanisms underlying chronic pain (30). These findings highlight the need for further development of physiotherapy education to ensure that the biopsychosocial approach can be implemented consistently in everyday clinical practice and in accordance with the principles of contemporary evidence-based rehabilitation.

Despite the limitations of the biopsychosocial model, there is compelling evidence that psychosocial factors play a crucial role in the development of chronic pain and long-term disability. Cognitive factors, such as pain catastrophizing and maladaptive pain beliefs; psychological factors, such as anxiety and depression; and social factors, including job dissatisfaction, family-related stress, and lack of social support, have all been associated with poorer treatment outcomes, reduced participation in rehabilitation, and an increased risk of developing chronic low back pain (33–36). Failure to recognize and address these factors may result in unnecessary patient suffering, reduced functional capacity, prolonged work absence, and increased burden on healthcare systems (37). Therefore, contemporary evidence supports not only the identification of psychosocial factors but also their active inclusion as important therapeutic targets within physiotherapy rehabilitation.

CONCLUSION

Chronic pain has well-established emotional and behavioural consequences that contribute to the development of persistent disability and influence both the rate and quality of recovery. Nevertheless, psychosocial factors are not routinely assessed in clinical practice, nor are they adequately incorporated into treatment strategies. The biopsychosocial model proposes that cognitive, emotional, psychological, behavioural, physical, and social factors interact to perpetuate pain and should therefore be addressed through integrated, multimodal interventions.

Chronic low back pain is the most prevalent chronic health condition worldwide and represents one of the most significant public health challenges of our time. Furthermore, it is a complex condition in which physical, psychological, and social factors interact, making management from a biopsychosocial perspective the most appropriate approach.

Uncertainty regarding the selection of appropriate screening tools, together with clinical practice that continues to prioritize the biomedical rather than the biopsychosocial model, may discourage clinicians from routinely assessing psychosocial factors. Consequently, integrating yellow flag screening into everyday physiotherapy practice remains a considerable challenge. Clinicians require practical guidance, as well as additional education, on how to implement screening tools, interpret their findings, and use the results to support shared decision-making.

Future research should focus on empirically validating the biopsychosocial framework by investigating the interactions among biological, psychological, and social factors and their contribution to symptom onset, symptom persistence, and rehabilitation outcomes in individuals with chronic low back pain. Such research would further strengthen the theoretical foundation and clinical applicability of the biopsychosocial model while improving our understanding of the complex nature of chronic pain.

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COGNITIVE–MOTOR EXERGAMING TRAINING IN AN OLDER PATIENT WITH DEPRESSION AND PSYCHOTIC SYMPTOMS

Kognitivno-motorički exergaming trening kod starije pacijentice s depresijom i psihotičnim simptomima

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ABSTRACT

Introduction: Depression in older adults is frequently associated with psychomotor slowing, impaired mobility, and increased fear of falling. The aim of this paper is to describe the effects of cognitive–motor exergaming training on functional mobility and fear of falling in an older patient with a severe depressive episode and psychotic symptoms.

Case presentation: A 75-year-old female patient was hospitalised at the Department of Psychogeriatrics, University Psychiatric Hospital Vrapče, Zagreb, Croatia, due to a severe depressive episode with psychotic symptoms (F32.3). During hospitalisation, physiotherapy interventions were performed with emphasis on cognitive–motor exergaming training using the Dividat Senso platform between March 2025 and March 2026, with a four-month interruption due to significant psychiatric deterioration.

Conclusion: During exergaming sessions, the patient demonstrated better functional performance, safer movement, and reduced fear of falling compared with everyday hospital activities. Functional mobility gradually improved despite persistent fear of falling. Cognitive–motor exergaming training may represent a useful physiotherapy intervention in psychogeriatric patients with complex psychomotor impairments.

Keywords: Depression; Psychomotor Disorders; Accidental Falls; Exercise Therapy; Rehabilitation

SAŽETAK

Uvod: Depresija kod osoba starije životne dobi često je povezana s psihomotornim usporanjem, narušenom pokretljivošću i povećanim strahom od pada. Cilj ovog rada je prikazati učinak kognitivno-motoričkog exergaming treninga na funkcionalnu pokretljivost i strah od pada kod starije pacijentice s teškom depresivnom epizodom i psihotičnim simptomima.

Prikaz slučaja: Prikazuje se slučaj 75-godišnje pacijentice hospitalizirane na Zavodu za psihogerijatriju Klinike za psihijatriju Vrapče u Zagrebu zbog teške depresivne epizode s psihotičnim simptomima (F32.3). Tijekom hospitalizacije provedene su fizioterapijske intervencije s naglaskom na kognitivno-motorički exergaming trening na Dividat Senso platformi u razdoblju od ožujka 2025. do ožujka 2026. godine, uz četveromjesečni prekid zbog značajnog pogoršanja psihičkog stanja.

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Zaključak: Tijekom exergaming treninga pacijentica je pokazivala bolju funkcionalnu izvedbu, sigurnije kretanje i smanjen strah od pada u odnosu na svakodnevne bolničke aktivnosti. Funkcionalna pokretljivost postupno se poboljšala unatoč perzistirajućem strahu od pada. Kognitivno-motorički exergaming trening mogao bi predstavljati korisnu fizioterapijsku intervenciju u rehabilitaciji psihogerijatrijskih pacijenata sa složenim psihomotoričkim ograničenjima.

Ključne riječi: depresija; psihomotorni poremećaji; padovi; terapija vježbanjem; rehabilitacija



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INTRODUCTION

Depression in older adults is frequently associated with cognitive and motor impairments. When psychotic symptoms are also present, these disturbances may become even more pronounced. Psychomotor slowing, changes in gait pattern and gait speed, impaired postural control, and insecurity during movement negatively affect activity levels and functional independence (1–3).

Motor difficulties are closely related to cognitive impairments, including reduced attention, slower information processing, delayed reaction time, and impaired cognitive flexibility, as cognitive functions play an important role in movement planning, initiation, and control (4,5). In addition, psychopharmacological treatment may negatively affect motor functioning (6,7). Fear of falling represents one of the major factors limiting mobility in older adults with depression. Its presence may lead to avoidance of movement and daily activities, loss of confidence, functional decline, and increased dependence on others (8,9).

In recent years, increasing attention has been paid to therapeutic approaches that simultaneously target cognitive, motor, and psychological factors associated with functional mobility. One such approach is cognitive–motor exergaming training, which combines simultaneous motor and cognitive task performance through interaction with a virtual or computer-based system (10,11).

Despite growing evidence that cognitive-motor exergaming enhances balance, mobility, cognition and fall prevention in older adults, evidence regarding its application in psychogeriatric patients with severe depression and psychotic symptoms remains limited.

The aim of this report was to describe the effects of long-term cognitive–motor exergaming training on functional mobility and fear of falling in an older patient with depression and psychotic symptoms.

CASE PRESENTATION

Ethical considerations

According to institutional and national regulations, formal ethical approval was not required because this report represents a non-interventional retrospective case report based solely on fully anonymised data obtained from routine physiotherapy documentation and medical records, without any additional interventions or prospective data collection performed for research purposes.

Initial assessment

A 75-year-old female patient was hospitalised at the Department of Psychogeriatrics, University Psychiatric Hospital Vrapče, Zagreb, Croatia, due to worsening psychiatric symptoms within a severe depressive episode with psychotic symptoms (F32.3; fourth hospitalisation). During hospitalisation, marked fluctuations in psychiatric status were observed, accompanied by pronounced psychomotor slowing and periods of reduced cooperation. The clinical course was additionally complicated by frequent modifications of psychopharmacological therapy, including initiation, discontinuation, and dose adjustments of multiple medications, which further influenced psychomotor functioning.

Changes in psychiatric status appeared to parallel changes in motor functioning. At admission, the patient was independently ambulatory, although gait in anteropropulsion with forward displacement of the centre of mass was observed. Fall risk assessment using the Timed Up and Go (TUG) test yielded a result of 12 seconds, suggesting a relatively low fall risk. Due to severe psychotic symptoms, a more comprehensive assessment of balance and functional mobility could not be performed. No major motor or cognitive impairments were identified, and the Mini-Mental State Examination (MMSE) score was 26/30.

Despite relatively preserved motor capacity, the patient frequently verbalised an inability to stand up or walk independently. Fear of falling was assessed through clinical evaluation, including patient self-reports, observation of behaviour during mobility activities and the level of assistance required for ambulation, rather by means of a standardised questionnaire. Depending on psychiatric status, she ambulated with assistance from one or two physiotherapists over distances ranging from 20 to 200 metres. She participated in daily structured group exercise sessions as part of the physiotherapy programme at the psychogeriatric department. Transcranial direct current stimulation (tDCS) was also administered for 30 days, without notable improvement in depressive symptoms. Fear of falling further increased after the patient sustained a minor head contusion following a fall while getting out of bed, although neuroradiological examination showed no intracranial injury.

Intervention

Cognitive-motor exergaming training using the Dividat Senso platform (Figure 1) was performed between March 2025 and March 2026, with a four-month interruption due to marked psychiatric deterioration. During this period, walking distance decreased to less than 10 metres, gait became highly unstable, and physiotherapy interventions were often not feasible. An attempt to adapt exergaming training to seated tasks was unsuccessful.

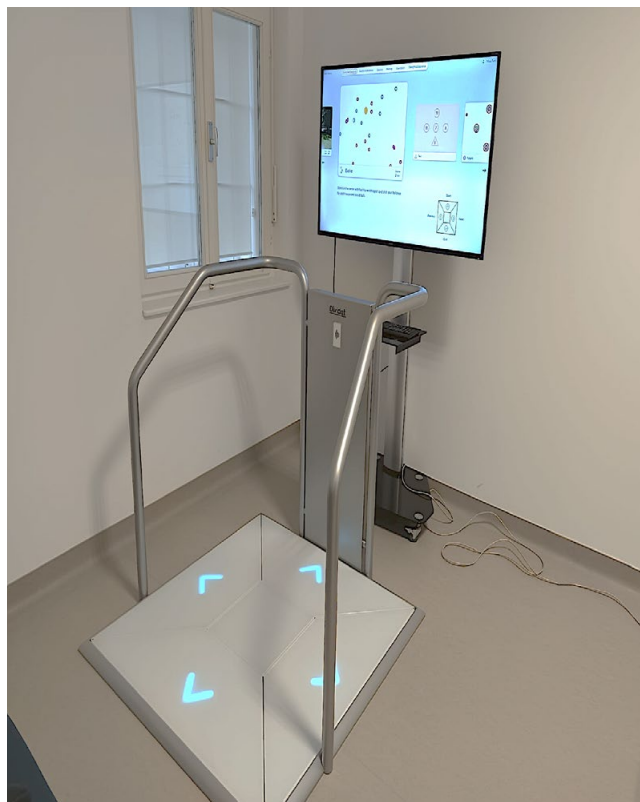


Figure 1. Dividat Senso platform

Following partial psychiatric stabilisation and re-establishment of walking distances between 50 and 100 metres with assistance from two physiotherapists, the patient resumed exergaming training. The Dividat Senso system is an interactive cognitive-motor training platform consisting of pressure-sensitive plates connected to a visual display. Training tasks simultaneously require motor responses and cognitive processing, including weight shifting, stepping, balance control, and task-specific decision-making. Main outcome measures provided by the platform included average reaction time, expressed in milliseconds (ms), and task performance scores, expressed as points generated by the platform software, with higher scores indicating better task performance.

Longitudinal clinical course and exergaming observations

During cognitive-motor exergaming training, the patient demonstrated better functional performance than in everyday hospital conditions, with safer movement and improved coordination. Fear of movement and fear of falling were also less pronounced during task performance.

Longitudinal exergaming data demonstrated marked variability in performance throughout hospitalisation (Table 1). Periods of relative psychiatric stabilisation were associated with shorter reaction times and better performance on both Simple and Flexi tasks, whereas psychiatric deterioration was accompanied by substantial worsening of performance, including inability to continue training.

A marked discrepancy was observed between the patient's actual motor abilities and her functional performance in everyday hospital settings. During exergaming sessions, the patient independently performed complex motor tasks while simultaneously solving cognitive tasks without pronounced fear of falling. However, immediately after completion of training, gait insecurity and fear of falling reappeared, and assistance during ambulation again became necessary.

At discharge, three months after reintroduction of training, the patient was able to independently transfer from lying to sitting, stand up independently, and ambulate with support using a handrail over distances up to 50 metres. Although fear of falling persisted, functional mobility improved, along with a slight improvement in cognitive status (MMSE 27/30).

DISCUSSION

This longitudinal case report highlights the complex interaction between psychiatric illness, psychomotor functioning, fear of falling, and functional mobility in an older patient with depression and psychotic symptoms. Worsening psychiatric status was accompanied by greater psychomotor slowing, gait instability, reduced activity levels, and increased fear of falling, consistent with previous findings regarding the relationship between depression and motor functioning in older adults (1–3,12,13).

A particularly notable finding was the discrepancy between preserved motor capacity and reduced functional performance in everyday hospital conditions. During exergaming training, the patient successfully performed complex motor tasks without marked fear of falling, whereas gait insecurity and need for assistance reappeared immediately after training. This pattern suggests an important role of psychological factors, particularly fear of falling and avoidance behaviour, in limiting functional mobility.

Cognitive–motor exergaming training may have contributed to improved functional mobility by simultaneously activating motor and cognitive functions in a structured, safe environment. Previous studies have demonstrated positive effects of cognitive–motor training on balance, gait, executive functions, and fall risk in older adults (11,15–21). In the present case, the most notable observation was that the patient's sense of safety during movement appeared greatest while actively engaged in training tasks.

The findings of this report should be interpreted with caution, given the nature of a single-case report and the concurrent implementation of multiple therapeutic interventions. Nevertheless, the report suggests potential usefulness of cognitive–motor exergaming training in the rehabilitation of psychogeriatric patients with complex psychomotor impairments.

Table 1. Longitudinal changes in exergaming performance and clinical status during hospitalisation

Clinical phase	Period	Psychiatric / functional status	Simple task – average reaction time	Simple task – points	Flexi task – points	Clinical interpretation
Initial phase	Feb–Mar 2025	Initial stabilization; ambulatory with assistance; persistent fear of falling	~1710–2942 ms	47–70	12–26	Moderate cognitive–motor performance with variability
Relative stabilization	Apr–May 2025	Improved participation during training	~1390–1621 ms	71–86	18–28	More stable performance and improved reaction times
Clinical deterioration	Jun–Jul 2025	Marked psychiatric worsening; unstable gait; walking distance <10 m	~3688–41637 ms	0–31	6–20	Severe decline in cognitive–motor performance
Training interruption	Aug–Dec 2025	Severe deterioration; exergaming not feasible	No valid recordings	No valid recordings	No valid recordings	Training interruption due to psychiatric decompensation
Re-stabilization	Jan–Mar 2026	Partial recovery; resumed exergaming training	~1350–1507 ms	72–98	25–38	Marked improvement in reaction time and task performance
Discharge	Mar 2026	Independent transfers and assisted ambulation up to 50 m	Stable performance maintained	High point scores maintained	High point scores maintained	Functional improvement despite persistent fear of falling

Abbreviations: ms = milliseconds. Simple and Flexi task scores represent platform-generated task performance scores, with higher values indicating better cognitive–motor performance.

CONCLUSION

Cognitive–motor exergaming training may represent a useful rehabilitation approach in older adults with depression and psychotic symptoms. In the present case, functional mobility improved despite persistent fear of falling. The discrepancy between performance during exergaming and everyday mobility suggests that cognitive–motor exergaming may offer a structured environment that facilitates movement and may reduce movement related fear, thereby supporting functional engagement in psychogeriatric rehabilitation. The findings highlight the importance of simultaneously addressing motor, cognitive, and psychological factors associated with functional recovery. Further research is needed to clarify the long-term effects and underlying mechanisms of this type of intervention.

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FACILITACIJOM DO AKTIVNOG POKRETA

Facilitation towards active movement

SANJICA VLAŠIĆ¹, MARINA BRIZIĆ¹<https://doi.org/10.64542/pc1.20.7>

SAŽETAK

Uvod: Facilitacija pokreta je jedna od najstarijih intervencija fizioterapeuta koja ima svrhu olakšavanja i poticanja aktivnog pokreta. Fenomen facilitacije kao interaktivne komunikacije pacijenta i fizioterapeuta teorijski je bilo složeno za objasniti. U facilitaciji nema suvišnog verbaliziranja ni fizioterapeuta ni pacijenta već usredotočenost na motorički zadatak. Unutar facilitacije kad se dogodi pokret jedina komunikacija su kratka odobravanja fizioterapeuta. Sva duža i veća verbaliziranja dekoncentriraju pacijenta i umanjuju učinkovitost facilitacije. Cilj ovog rada bio je pregledati dostupnu literaturu i procijeniti učinkovitost i primjenu facilitacije pokreta u fizioterapiji.

Materijali i metode: Pretražene su baze podataka PubMed/MEDLINE, ResearchGate i Hrčak za razdoblje od 2016. do 2026. godine. Pretraživanje je provedeno primjenom ključnih riječi i njihovih kombinacija: facilitacija pokreta, neurofacilitacija, hands-on facilitacija, facilitacija aktivnog pokreta, aktivna participacija, fizioterapija, Bobath, PNF. U analizu su uključeni cjeloviti radovi dostupni na hrvatskom ili engleskom jeziku koji su se odnosili na primjenu facilitacije pokreta u fizioterapiji.

Rezultati: Pretraživanjem literature identificirano je ukupno 58 radova koji spominju i istražuju facilitaciju pokreta u fizioterapiji. Nakon pregleda radova prema unaprijed definiranim kriterijima uključivanja i isključivanja, u završnu analizu uključeno je devet radova, većina na temu rehabilitacije nakon moždanog udara.

Zaključak: Facilitacija pokreta može se promatrati kao specifična fizioterapijska intervencija usmjerena na poticanje i poboljšanje aktivnih pokreta. Primjenom odgovarajućih manualnih, senzornih i motoričkih podražaja fizioterapeut pacijentu omogućuje iskustvo učinkovitijeg izvođenja pokreta, potičući pritom aktivnu participaciju i ponovno uspostavljanje funkcionalnog pokreta. Iako primjenjiva u svim područjima fizioterapije, u literaturi je najzastupljenija primjena facilitacije u neurofizioterapiji.

Ključne riječi: facilitacija pokreta, fizioterapija, neurorehabilitacija

ABSTRACT

Introduction: Movement facilitation is one of the oldest physiotherapy interventions aimed at facilitating and promoting active movement. The phenomenon of facilitation as an interactive form of communication between the patient and the physiotherapist has been theoretically complex to explain. During facilitation, unnecessary verbalization by either the physiotherapist or the patient is avoided, with attention focused on the motor task. When movement occurs during facilitation, communication is limited to brief verbal affirmations from the physiotherapist. More extensive verbalization may distract the patient and reduce the effectiveness of facilitation. The aim of this study was to review the available literature and evaluate the effectiveness and application of movement facilitation.

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tion in physiotherapy.

Materials and Methods: The PubMed/MEDLINE, ResearchGate, and Hrčak databases were searched for the period from 2016 to 2026. The search was conducted using the following keywords and their combinations: movement facilitation, neurofacilitation, hands-on facilitation, active movement facilitation, active participation, physiotherapy, Bobath, and PNF. Full-text articles available in Croatian or English addressing the application of movement facilitation in physiotherapy were included in the analysis.

Results: The literature search identified a total of 58 articles that mentioned or investigated movement facilitation in physiotherapy. Following screening according to predefined inclusion and exclusion criteria, nine studies were included in the final analysis, the majority of which focused on rehabilitation after stroke.

Conclusion: Movement facilitation can be regarded as a specific physiotherapy intervention aimed at promoting and improving active movement. Through the application of appropriate manual, sensory, and motor stimuli, the physiotherapist enables the patient to experience more effective movement performance, while promoting active participation and the re-establishment of functional movement. Although applicable across all areas of physiotherapy, movement facilitation is most commonly represented in the literature within the field of neurological physiotherapy.

Keywords: movement facilitation, physiotherapy, neurorehabilitation



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rasle o neuroplastičnosti, neuromuskularnoj plastičnosti,

UVOD

Pojam facilitacija u fizioterapiji prvi put u povijesti se spominje početkom četrdesetih godina dvadesetog stoljeća kad se počinje razvijati koncept pod nazivom Proprioceptivna facilitacija. Teorijske temelje postavio je liječnik neurofiziolog dr. Herman Kabat i fizioterapeutkinja Margaret Knott. Teorijski temelji su na osnovu spoznaja o neurofiziološkim refleksima kako bi facilitirali živčane impulse i aktivirali muskulaturu. Desetak godina kasnije fizioterapeutkinja Dorothy Voss dodaje naziv Proprioceptivna neuromuskularna facilitacija (PNF). Drugi najpoznatiji koncept razvili su bračni par fizioterapeutkinja Berta Bobath i liječnik neurolog Karel Bobath 1943. godine. Facilitaciju počinju spominjati i ugrađivati u svoj koncept kasnije tijekom 1960-ih do službeno 1970. godine. Uvođenje facilitacije funkcionalnog pokreta u Bobath koncept uvedeno je nakon što početna teorija inhibicije patoloških pokreta sama po sebi nije bila dovoljna. U početku njihova razmišljanja su bila inhibiranjem patoloških refleksa dogodit će se normalan pokret. Izjavom "Naš zadatak je pacijentu vratiti osjećaj pokreta" Berte Bobath je postavljen temelj koncepta (1).

Značenje facilitacije u fizioterapiji, sama riječ facilitacija dolazi od latinske riječi facilis (lak), što u kontekstu fizioterapije označava olakšavanje i promicanje voljne mišićne kontrakcije i funkcionalnog pokreta stimulacijom živčanog sustava (preko receptora u koži, mišićima, tetivama i zglobovima). U ranijim razdobljima facilitaciju se objašnjavalo na razini neurofiziologije kako su spoznaje

počelo se razmišljati kako ulazna informacija preko senzornih tjelesaca na periferiji stimulira neuroplastične promjene u središnjem živčanom sustavu (2). Smatralo se kako fizioterapeut facilitacijom pokreta adekvatnim vođenjem može izazvati adekvatnu neuroplastičnost (3). Naprednim razmišljanjima fizioterapeuta kliničara počinje se razumijevati složenost facilitiranja pokreta koji su oslabljeni i primjetljivi su jedino fizioterapeutu koji je u kontaktu s pacijentom. Proces u kojem su u međusobnoj tjelesnoj komunikaciji terapeut i pacijent preko vođenja pokreta. U facilitaciji fizioterapeuti osjećaju povezanost s živčanim sustavom pacijenta osluškujući reakcije na podražaj koji mu daju. Tako se omogućava lakši i osvješteniji pokret kojeg sam pacijent može osjetiti. Članica udruženja Bobath instruktora (IBITA) Lynne Fletcher krajem 20 stoljeća predlaže model osobne komunikacije i facilitaciju dijeli u tri dijela: Omogućiti pokret, učiniti pokret potrebnim, dopustiti pokretu da se dogodi (4). Fenomenologija, koja tijelo doživljava kao središte iskustva i izražavanja nudi put do razumijevanja takvih praktičnih interakcija kao oblik komunikacije (5). Pokret koji se facilitira tijekom tretmana trebao bi biti što je moguće normalniji, a informacije kroz kožu, zglobove, mišiće adekvatne u vremenskim i prostornim okvirima.

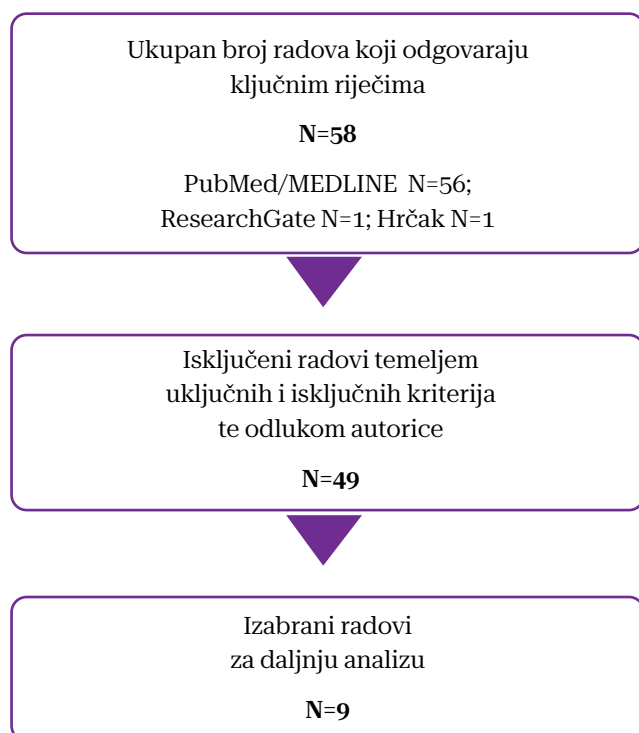
Cilj ovog rada bio je pregledati dostupnu literaturu i procijeniti učinkovitost facilitacije pokreta u poboljšanju funkcionalnog statusa pacijenata u fizioterapiji.

Materijali i metode: Pretražene su baze podataka PubMed/MEDLINE, ResearchGate i Hrčak za razdoblje od 2016. do 2026. godine. U pretraživanju su korištene ključne riječi i njihove kombinacije: facilitacija, fizioterapija, hands-on facilitacija, facilitacija aktivnog pokreta i aktivna participacija što je dodatno prošireno ključnim riječima neurofacilitacija, moždani udar, Bobath, PNF. Daljnjim pregledom temeljem slijedećih uključnih kriterija: radovi koji su istraživali učinkovitost primjene facilitacijskih intervencija, punoljetne osobe, ispitanike koji su preživjeli moždani udar te radovi koji su opisali primjenu Bobath i PNF koncepta autorica se odlučila za devet radova koji su ušli u daljnju analizu. Isključeni su radovi u kojima se obrađivala primjena PNF-a za mišićno-koštanu problematiku, za bolesti perifernog živca i za dječju populaciju.

REZULTATI

Najzastupljeniji su u bazama podataka istraživački radovi o facilitaciji na pacijentima s preboljelim moždanim udarom pa su kao takvi izabrani za završnu analizu.

Rezultati prikupljanja radova prikazani su prizma dijagramom (Slika 1.) dok je završna analiza uključenih radova prikazana u Tablici 1.



Slika 1. Prizma dijagram

RASPRAVA

Facilitacija pokreta je intervencija fizioterapeuta na pacijentu koji ne može samostalno pokrenuti željeni dio tijela i izvršiti neku funkciju. Facilitacija je aktivni proces kad iskustvo pokreta nije moguće na drugi način. Najčešća stanja; cerebrovaskularnih bolesti, bolesti perifernih živaca, traumatskih oštećenja tkiva, postoperativnih kirurških i ortopedskih, dovode do gubitka funkcije pokreta ekstremiteta i oslabljene jakosti miškulature te su primjenjive intervencije facilitacije pokreta. Pri neurološkim oštećenjima središnjeg živčanog sustava gubi se dodatno stabilnost trupa sa smanjenim funkcijama pokreta ekstremiteta i što su veća oštećenja kompleksnija je klinička slika (6). Facilitacije pokreta oslabljene jakosti kad je očuvana mogućnost kognicije pokazuje dobre rezultate povratka aktivnog pokreta. Pacijenti koji nemaju antigravitacijski aktivni pokret ekstremiteta i kontrolu trupa trebaju fizioterapeutsku intervenciju facilitiranja pokreta sa stabilizacijom trupa (7). Prilikom facilitiranja pokreta fizioterapeut daje ulaznu informaciju preko dijela tijela kojeg želi pokrenuti u točno određenom pravilnom položaju kako bi pacijent imao osjećaj mogućeg aktivnog kontinuiranog pokreta. Uz fizioterapeuta željeni pokret postaje moguć te pacijenti imaju osjećaj sudjelovanja u njemu. Fizioterapeutska intervencija facilitiranja dovodi pacijenta u situaciju koja zahtjeva neophodni nužni pokret. Komunikacijski aspekti facilitacije su taktilnog tipa manje verbaliziranja motoričkog zadatka. Komunikacija između terapeuta i pacijenta je na senzornoj taktilnoj razini uz eventualnu kratku verbalnu informaciju usmjerenja pokreta. Na početku tretmana pacijentu se predstavljaju ciljevi intervencije i način izvedbe kako u samoj facilitaciji ne bi došlo do dekoncentracije pacijenta s previše verbaliziranja od strane terapeuta. Pacijenti u facilitaciji trebaju dobiti intrinzični osjećaj za tijelo i pokret. Za facilitaciju je potrebna suradnja pacijenta i njegova koncentracija na postavljeni motorički zadatak kako bi dopustio da se traženo kretanje dogodi (8). Ova koncepcija omogućuje percepciju praktične interakcije tijekom olakšavanja kretanja kao aspekta komunikacije između dva utjelovljena subjekta (5). Koriste se kombinacije prilagodbama motoričkih zadataka i okoline kako bi se optimiziralo ponovno učenje pokreta pacijenata s neurološkim stanjima (2,3). U novije vrijeme ne razmišljamo o pacijentu koji uči pokret već pokrete imamo pohranjene u sebi i samo ih treba osvijestiti (9). Odrasle osobe imaju iskustvo pokretanja koje su razvili radom i razvojem generirane u sustavu zaduženom za pokretanje. Većina naših pokreta je na automatskoj razini i ne razmišljamo kako se pokrećemo dok se ne susretnemo s nečim novim koji iziskuje razmišljanje o provedbi motoričkog zadatka (2). Gledajući na novonastale situacije gubitka sposobnosti pokreta pacijenti počinju uz pomoć terapeuta analizirati pokret u najmanje dijelove pokreta.

AUTOR I GODINA OBJAVE	NASLOV RADA (eng.)	DIZAJN ISTRAŽI- VANJA	CILJ RADA	TESTOVI I MJERENJA	ZAKLJUČAK AUTORA
Francesc Xavier Guiu- Tula, 2017.	The Efficacy of the proprioceptive neuromuscular facilitation (PNF) approach in stroke rehabilitation to improve basic activities of daily living and quality of life: a systematic review and meta-analysis protocol	Sustavni pregledni rad (PEDro scale)	Učinkovitost PNF na ADŽ i kvalitetu života nakon moždanog udara. Posebni naglasak na posturalnu kontrolu, hod, funkciju GE i jakost mišićne mase	Barthel Index, Functional Independence Measures (FIM), modified Ranking Scale (mRS), Community Integration Questionnaire (CIQ). QOL, Short Form 36 (SF-36), Stroke Specific Quality of Life Scale (SS-QOL).	PNF je učinkovit pristup koji poboljšava ADŽ i kvalitetu života
Vishal Sharma, 2017.	Effect of core strengthening with pelvic proprioceptive neuromuscular facilitation on trunk, balance, gait, and function in chronic stroke	Izvorni znanstveni rad	Procijeniti učinke jačanja trupa u kombinaciji s proprioceptivnom	Trunk Impairment Scale, Tinetti Performance Oriented Mobility Assessment (Tinetti-POMA), Balance Evaluation Systems Test (Mini-BESTest), Wisconsin Gait Scale, and Barthel Activities of Daily Living Index	Stabilizacija trupa u kombinaciji s PNF-om zdjelice bila je učinkovitija za poboljšanje oštećenja trupa, ravnoteže i hoda pacijenata s kroničnim moždanim udarom nego kontrolna PNF zdjelice s vježbama fleksibilnosti trupa
Britt Normann 2018.	Facilitation of movement: New perspectives provide expanded insights to guide clinical practice	Izvorni znanstveni rad	Svrha ovog rada je istražiti teorijske temelje za facilitacijski pristup korištenjem proširenog okvira	Analiza spoznaja i znanstvene literature	Fenomenologija koja promatra facilitaciju kao svojevrsnu komunikaciju terapeuta i pacijenta, praktična interakcija
Katharine Scrivener 2020.	Bobath therapy is inferior to task-specific training and not superior to other interventions in improving lower limb activities after stroke: a systematic review	Sustavni pregledni rad (PEDro scale)	Istražiti učinkovitost između Bobath pristupa, pristupa orijentiranog na zadatak i spontanog oporavljanje nakon moždanog udara	STS, ravnoteža u hodu, jakost i koordinacija donjih ekstremiteta	Bobath terapija bila je inferiorna u odnosu na pristup orijentiran na zadatak, a ne i superiornija u odnosu na druge intervencije, s izuzetkom proprioceptivne neuromuskularne facilitacije. Trenutni dokazi ne podupiru davanje prioriteta Bobath terapiji u odnosu na druge intervencije.

AUTOR I GODINA OBJAVE	NASLOV RADA (eng.)	DIZAJN ISTRAŽI- VANJA	CILJ RADA	TESTOVI I MJERENJA	ZAKLJUČAK AUTORA
María J. Díaz- Arribas 2019.	Effectiveness of the Bobath concept in the treatment of stroke: a systematic review	Sustavni pregledni rad (PEDro scale)	Evalvirati učinkovitost Bobath terapije na senzomotornu rehabilitaciju nakon moždanog udara	Spretnost gornjih ekstremiteta, motorička kontrola i hod donjih, mobilnost, stabilnost, ADŽ	Sveukupni radovi nisu pokazatelj Bobath terapije ispred drugih pristupa u funkcionalnom oporavku i motoričkoj kontroli
Phan The Nguyen 2022.	Proprioceptive Neuromuscular Facilitation- Based Physical Therapy on the Improvement of Balance and Gait in Patients with Chronic Stroke: A Systematic Review and Meta- Analysis	Sustavni pregledni rad (PEDro scale) Meta analiza	Utvrđiti potencijalnu korist PNF-a za ravnotežu i funkciju hoda kod pacijenata s kroničnim moždanim udarom	Berg Balance Scale (BBS), Functional Reach Test (FRT), Timed Up and Go Test (TUG) and 10-Meter Walking Test (10MWT)	Pokazuje da je PNF potencijalna strategija liječenja kroničnog moždane udara rehabilitacija ravnoteže i brzine hoda. Potrebna su daljnja visokokvalitetna istraživanja kako bi se postigao konsenzus o intervenciji i istraživanju PNF-a.
Mirko Ljubas 2025.	Primjena Bobath koncepta kod pacijenta s hemiparezom u kućnoj fizikalnoj terapiji	Sustavni pregledni rad	Utvrđiti učinkovitost Bobath fizioterapije u kućnim uvjetima bolesnika poznate okoline	Procijena funkcionalne samostalnosti ADŽ	Pristup poboljšava funkcionalnost u stvarnom životu, što rezultira većom samostalnošću pacijenta u ADŽ
Sofia Marques 2026.	Addressing the theory-practice gap: a qualitative study of Bobath and non-Bobath physiotherapists using the rehabilitation treatment specification system (RTSS)	Izvorni znanstveni rad	Istražiti sličnost i razlike u kliničkoj praksi i izborima intervencija fizioterapeuta s Bobatom i onih koji to nisu u jednom tretmanu s moždanim udarom pacijenta	Video simanje fizioterapeuta procijenjujući pristup, odabir intervencija i cilj tretmana	Bobath terapeuti češće koriste maualne facilitacije, senzorne informacije, trening posturalne kontrole i hod, dok Ne-Bobath terapeuti više koriste jačanje snaga muskulature i strategije edukacije i angažmana
Izel Demirhan 2026.	The Efficacy of Proprioceptive Neuromuscular Facilitation-Based Robot-Assisted Therapy in Individuals With Stroke: A Randomized Controlled Trial	Izvorni znanstveni rad	Istražiti učinkovitost PNF i robotske terapije pacijenata s moždanim udarom na funkcije gornjih ekstremiteta	Fugl-Meyer Upper Extremity scale, action Resarch Arm Test, Box and Block, 9Hole Peg, mAshworth scale, ADL, QOL	Konvencionalni tretman u kombinaciji PNF i RAT pokazuje puno učinkovitiji tretman za smanjenje spasticiteta, bolju motoričku izvedbu, u ADŽ i kvaliteti života na gornje ekstremitete pacijenata s moždanim udarom

Tablica 1. Završna analiza radova

Najmanji dijelovi pokreta su selektivni pokreti koje facilitiramo i ugrađujemo ih u veliki pokret kinetičkog lanca. Odabir radova koji su korišteni za završnu analizu ovog rada prikazuju dva najraširenija koncepta PNF i Bobath koji koriste facilitaciju te su pretežno u neurorehabilitaciji. Najčešće su u bazama podataka istraživački radovi na preboljelim moždanim udarima pa su kao takvi izabrani za završnu analizu ujednačenih kriterija. Oba koncepta osim neuroloških problematika koriste se i na drugim stanjima koja imaju za posljedicu gubitak aktivnog antigravitacijskog pokreta. Razlika je u pristupu između neuroloških fizioterapeuta i ostalih terapeuta po odabiru intervencija. Istraživanje grupe autora uz pomoć video snimanja tretmana to analizira i potvrđuje razlike. Bobath terapeuti češće koriste manualne facilitacije, senzorne informacije, trening posturalne kontrole i hod, dok Ne-Bobath terapeuti više koriste jačanje snaga miškulature, strategije edukacije i angažmana, kompenzacijske strategije (9). U kliničkoj praksi se često ova dva spomenuta velika koncepta bore za primat i bolju učinkovitost dok radovi pokazuju slične rezultate poboljšanja kvalitete života i aktivnosti dnevnog života (10,11,12,13). Pregledom baza podataka vidljivo je veća aktivnost PNF terapeuta s većim brojem istraživačkih radova. Grupa autora u istraživačkom radu objavljenom 2026. dolaze do zaključka kako kombinacija konvencionalne terapije, PNF i neurorobotike za gornje ekstremitete (RAT eng. robot-assisted therapy) pokazuje puno učinkovitiji tretman za smanjenje spasticiteta, bolju motoričku izvedbu, ADŽ i kvaliteti života pacijenata s moždanim udarom (14). Dobrobit i bolju učinkovitost za pacijente s preboljelim moždanim udarom imaju pacijenti s kojima se provodila fizioterapija u njihovim životnim prostorima. Utjecaj okoline u kojoj pacijent živi, koju prepoznaje, te podrška i uključivanje obitelji u tretman daju dobre rezultate povećane funkcionalnosti (15). Primjenom pristupa orijentiranom na motorički zadatak što se kućnim uvjetima može bolje terapijski kreirati potvrđuje tezu autora koji dokazuju najučinkovitiji takav pristup (eng. Task-oriented interventions). U istraživačkom radu uspoređivale su se tri grupe ispitanika; Bobath pristup, PNF pristup te Pristup orijentiran na motorički zadatak koji je pokazao mjerenjem ishoda najbolje rezultate (16). U daljnjim istraživanjima trebalo bi standardizirati pristup koji bi bio najučinkovitiji u odnosu na težinu moždanog udara i razdoblju od preboljelog moždanog udara. U većini analiziranih radova u ovom preglednom radu ne može se vidjeti radi li se o akutnom, subakutnom, kroničnom razdoblju nakon moždanog udara i njegova težina. Proteklo razdoblje od moždanog udara i njegova težina uveliko utječu na odabir intervencije i ishode učinka. Jedan istraživački rad zaključuje u prilog PNF koncepta koji je u njihovom istraživanju najbolji za kronična stanja nakon moždanog udara, ali se istovremeno u zaključku ograđuje da su potrebna daljnja istraživanja na tu temu (17).

ZAKLJUČAK

Facilitaciju možemo promatrati kao specifičnu fizioterapeutsku intervenciju na oslabljene pokrete. Fizioterapeut facilitacijom pacijentu daje iskustvo pokreta koji je izgubio uslijed novonastalih stanja. Pacijentima facilitacija daje dodatnu motivaciju za samoinicijacije pokreta i povezanost s fizioterapeutom. U facilitaciji surađuju povezani fizioterapeut i pacijent u specifičnoj komunikaciji o kojoj možemo razmišljati kao fenomenu u fizioterapiji. Dobrom facilitacijom kod pacijenta postizemo uvažavanje naše praktične vještine, njihovu suradnju s nama te uspostavljanje izgubljenih pokreta. Rezultati analiziranih istraživanja upućuju na potencijalnu korist facilitacije pokreta u neurofizioterapiji nakon moždanog udara.

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PROPRIOCEPTIVNA NEUROMUSKULARNA FACILITACIJA U REHABILITACIJI PACIJENTICE S PROTRUZIJOM INTERVERTEBRALNIH DISKOVA

Proprioceptive neuromuscular facilitation in the rehabilitation of a patient with intervertebral disc protrusions

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SAŽETAK

Uvod: Sjedilački način života, nedovoljna razina tjelesne aktivnosti i pretilost povezani su s povećanim rizikom razvoja degenerativnih promjena kralježnice, uključujući protruziju intervertebralnog diska. Takve promjene mogu biti praćene boli, smanjenom pokretljivošću i ograničenjima u svakodnevnom funkcioniranju, što može negativno utjecati na tjelesno i psihološko zdravlje te kvalitetu života pojedinca. Jedan od fizioterapijskih pristupa koji se primjenjuje u rehabilitaciji osoba s mišićno-koštanim poremećajima jest proprioceptivna neuromuskularna facilitacija (PNF). Cilj ovog rada bio je prikazati učinke rehabilitacijskog pristupa temeljenog na PNF-u kod pacijentice s protruzijom intervertebralnih diskova.

Opis slučaja: Pacijentici u dobi od 62 godine, s dijagnosticiranom protruzijom intervertebralnih diskova i brojnim komorbiditetima, indicirana je fizioterapija. Vodeći simptom bila je bol, praćena značajnim ograničenjem aktivnosti i dugotrajnim mirovanjem tijekom prethodne godine. Početna fizioterapijska procjena uključivala je mjerenje pokretljivosti lumbalne kralježnice, procjenu intenziteta boli te procjenu funkcije i aktivnosti prema Međunarodnoj klasifikaciji funkcioniranja, onesposobljenosti i zdravlja (MKF). U svrhu postizanja kratkoročnih rehabilitacijskih ciljeva, prvenstveno smanjenja boli i povećanja pokretljivosti kralježnice, tijekom dva tjedna primjenjivan je rehabilitacijski pristup temeljen na proprioceptivnoj neuromuskularnoj facilitaciji. Nakon završetka intervencije provedena je završna fizioterapijska procjena.

Zaključak: Nakon dvotjedne primjene rehabilitacijskog pristupa temeljenog na proprioceptivnoj neuromuskularnoj facilitaciji zabilježeno je smanjenje intenziteta boli, povećanje opsega pokreta lumbalne kralježnice te poboljšanje funkcije i aktivnosti. Rezultati ovog prikaza slučaja upućuju na potencijalnu korist primjene PNF-a u rehabilitaciji pacijenata s protruzijom intervertebralnih diskova i funkcionalnim ograničenjima.

Ključne riječi: kralježnica, protruzija intervertebralnog diska, fizioterapija, proprioceptivna neuromuskularna facilitacija, bol

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ABSTRACT

Introduction: A sedentary lifestyle, insufficient levels of physical activity, and obesity are associated with an increased risk of developing degenerative spinal changes, including intervertebral disc protrusion. Such changes may be accompanied by pain, reduced mobility, and limitations in daily functioning, which can negatively affect physical and psychological health as well as an individual's quality of life. Proprioceptive neuromuscular facilitation (PNF) is one of the physiotherapy approaches used in the rehabilitation of individuals with musculoskeletal disorders. The aim of this case report was to describe the effects of a PNF-based rehabilitation approach in a patient with intervertebral disc protrusions.

Case Presentation: A 62-year-old female patient with diagnosed intervertebral disc protrusions and multiple comorbidities was referred for physiotherapy. The predominant symptom was pain, accompanied by significant activity limitations and prolonged inactivity during the previous year. The initial physiotherapy assessment included measurement of lumbar spine mobility, assessment of pain intensity, and evaluation of functioning and activity according to the International Classification of Functioning, Disability and Health (ICF). To achieve short-term rehabilitation goals, primarily pain reduction and improvement in spinal mobility, a rehabilitation approach based on proprioceptive neuromuscular facilitation was implemented over a two-week period. A final physiotherapy assessment was performed upon completion of the intervention.

Conclusion: Following two weeks of PNF-based rehabilitation, a reduction in pain intensity, an increase in lumbar spine range of motion, and improvements in functioning and activity were observed. The findings of this case report suggest that PNF may have potential benefits in the rehabilitation of patients with intervertebral disc protrusions and associated functional limitations.

Keywords: spine, intervertebral disc protrusion, physiotherapy, proprioceptive neuromuscular facilitation, pain



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UVOD

Hernija intervertebralnog diska jedan je od čestih poremećaja vertebralnog dinamičkog segmenta, pri kojem pomak sadržaja intervertebralnog diska može dovesti do kompresije ili iritacije korijena spinalnih živaca te pojave boli i drugih neuroloških simptoma, ovisno o razini i lokalizaciji hernijacije (1,2). Može se pojaviti u bilo kojem segmentu kralježnice, no najčešće zahvaća lumbalno područje, osobito razine L4–L5 i L5–S1 (1). Procjenjuje se da se incidencija simptomatske hernije intervertebralnog diska kreće između 5 i 20 slučajeva na 1000 odraslih osoba godišnje, pri čemu se najčešće javlja u radno aktivnoj populaciji između 30. i 50. godine života (3). Nastanak lumbalne hernije intervertebralnog diska povezuje se s brojnim čimbenicima rizika, uključujući dob, genetsku predispoziciju, pretilost, pušenje, intenzivna tjelesna opterećenja i učestalo podizanje teških tereta (2).

S obzirom na anatomsku lokalizaciju, hernija intervertebralnog diska može se klasificirati kao posterolateralna, centralna ili lateralna. Prema opsegu pomaka diskalnog

materijala razlikuju se različiti morfološki oblici, među kojima su ispupčenje, protruzija, ekstruzija i sekvestracija (3). U osoba s lumbalnom hernijom intervertebralnog diska mogu biti prisutne smanjena snaga i izdržljivost mišića trupa, uključujući leđnu i abdominalnu muskulaturu, što može biti povezano s boli i smanjenom funkcionalnom sposobnošću (4).

Terapijsko vježbanje predstavlja jednu od temeljnih konzervativnih intervencija u liječenju osoba s boli u lumbalnom dijelu kralježnice, s ciljem smanjenja simptoma, poboljšanja funkcije i povećanja sposobnosti izvođenja svakodnevnih aktivnosti (5,6). Jedan od fizioterapijskih pristupa koji se može primijeniti u rehabilitaciji osoba s lumbalnom boli jest proprioceptivna neuromuskularna facilitacija (PNF). PNF se temelji na facilitaciji neuromuskularne funkcije primjenom specifičnih obrazaca pokreta i tehnika uz korištenje proprioceptivnih, eksteroceptivnih i drugih senzornih podražaja s ciljem unaprjeđenja motoričke kontrole i funkcionalnog pokreta (7).

PNF je razvijen 1940-ih godina na temelju rada dr. Hermana Kabata, kojemu su se u daljnjem razvoju koncepta pridružile fizioterapeutkinje Margaret Knott i Dorothy Voss. Prvotno se primjenjivao pretežno u neurološkoj rehabilitaciji, dok je njegova primjena s vremenom proširena i na mišićno-koštana stanja. Daljnjem razvoju, edukaciji i kliničkoj primjeni koncepta najviše pridonosi stručni i znanstveni rad Međunarodne PNF organizacije (engl. International PNF Association - IPNFA) koja djeluje od 1990. godine (7–9).

PNF koncept obuhvaća filozofiju, osnovne principe facilitacije i specifične tehnike (7). Prema IPNFA-i, njegova se filozofija temelji na pozitivnom i funkcionalnom pristupu, mobilizaciji postojećih potencijala pacijenta, holističkom pristupu te načelima motoričkog učenja i motoričke kontrole (7,9). Terapijski pristup je individualiziran, usmjeren na funkcionalne ciljeve i aktivno sudjelovanje pacijenta te uzima u obzir tjelesne funkcije i strukture, aktivnosti, participaciju i individualne potrebe, što je u skladu s biopsihosocijalnim pristupom Međunarodne klasifikacije funkcioniranja, onesposobljenosti i zdravlja (ICF) (7,9,10).

Osnovni principi facilitacije uključuju primjenu odgovarajućeg otpora, iradijaciju i pojačanje, taktilnu, vizualnu i auditivnu stimulaciju, optimalan položaj tijela i biomehaniku, trakciju i aproksimaciju, istezanje, vremensko usklađivanje pokreta (timing) te specifične obrasce pokreta. Njihova se primjena individualno prilagođava funkcionalnim sposobnostima i terapijskim ciljevima pacijenta (9).

Cilj ovog rada bio je prikazati učinke rehabilitacijskog pristupa temeljenog na proprioceptivnoj neuromuskularnoj facilitaciji kod pacijentice s protruzijom intervertebralnih diskova i pridruženim komorbiditetima.

PRIKAZ SLUČAJA

Pacijentica u dobi od 62 godine, umirovljena odgajateljica, upućena je na fizioterapiju zbog kronične boli u lumbalnom dijelu kralježnice, čiji se intenzitet tijekom posljednjih nekoliko mjeseci povećavao te značajno ograničavao svakodnevno funkcioniranje i kvalitetu života. Prema nalazu magnetske rezonancije lumbalne kralježnice iz 2023. godine utvrđene su protruzije intervertebralnih diskova na razinama L1–L2, L4–L5 i L5–S1.

Na početku fizioterapijskog procesa provedena je sveobuhvatna fizioterapijska procjena koja je uključivala subjektivni i objektivni pregled. Subjektivnim pregledom prikupljeni su podatci o medicinskoj anamnezi, trenutnom zdravstvenom stanju, karakteristikama boli, razini tjelesne aktivnosti te ograničenjima u svakodnevnom funkcioniranju. Uvidom u medicinsku dokumentaciju utvrđeno je da je pacijentica imala kardiovaskularne komorbiditete, uključujući prethodno učinjenu perkutanu

koronarnu intervenciju s ugradnjom koronarnog stenta. U anamnezi je također bio prisutan depresivni poremećaj zbog kojeg je pacijentica bila u kontinuiranom psihijatrijskom liječenju (Tablice 1. i 2.). Navedeni komorbiditeti uzeti su u obzir prilikom planiranja i provođenja fizioterapijske intervencije.

Spol	Ženski
Zanimanje	Umirovljenica
Hobi	Kućanski poslovi
Glavna dijagnoza	Protrusio disci I.V L1-L2, L4-L5, L5-S1
Prijašnje dijagnoze	Klinička depresija (psihijatrijsko liječenje), 2020. ugrađen koronarni stent, 2024. Fractura collichirurgici humeri sin.
Funkcionalna dijagnoza	Otežane aktivnosti svakodnevnoga života; osobito aktivnosti koje zahtijevaju fleksiju trupa
Komorbiditeti	Ugrađen koronarni stent
Lijekovi	Antidepresivi, diazepam, lijekovi za srce, analgetici

Tablica 1. Opći podatci o pacijentici

Glavna subjektivna tegoba	Otežano pregibanje trupa i aktivnosti koje zahtijevaju fleksiju prema naprijed
Cilj pacijentice	Omogućiti saginjanje tijekom obavljanja kućanskih poslova
Okolišni čimbenici	Obiteljska kuća s približno 10 stepenica
Osobni čimbenici	Živi sa suprugom koji pruža pomoć u svakodnevnim aktivnostima
Mogućnost sudjelovanja	Samostalna pri obavljanju osobne higijene, oblačenja, hod (otežan)
Ograničenje sudjelovanja	Većina aktivnosti koje zahtijevaju fleksiju trupa
Samostalne aktivnosti	Hod, osobna higijena
Primarno ograničenje aktivnosti	Fleksija (pregibanje) trupa
Ograničenje funkcije	Smanjena mobilnost zbog protruzije diskova na više razina te povišen tonus paravertebralne muskulature = smanjena mobilnost

Tablica 2. Klinički status i funkcionalna procjena pacijentice

Kao dominantan simptom pacijentica je navela kontinuiranu bol u lumbalnoj regiji, koja se pojačavala tijekom aktivnosti koje su uključivale fleksiju trupa. Bol nije mogla precizno lokalizirati, a opisivala je njezino povremeno širenje kranijalno prema području lopatica te kaudalno prema glutealnoj regiji. Prema navodima pacijentice, povećanje intenziteta boli bilo je praćeno pogoršanjem subjektivnog psihološkog stanja. Također je navela svakodnevnu primjenu analgetika. Intenzitet boli procijenjen je vizualnom analognom skalom (VAS).

Prije razvoja zdravstvenih poteškoća pacijentica je, prema vlastitim navodima, bila tjelesno aktivna, a priroda njezina zanimanja uključivala je svakodnevno kretanje. Nakon značajnog traumatskog životnog događaja, razvoja depresivnog poremećaja i kardiovaskularnih poteškoća došlo je do postupnog smanjenja razine tjelesne aktivnosti. U vrijeme početne fizioterapijske procjene svakodnevne aktivnosti bile su uglavnom ograničene na aktivnosti samozbrinjavanja. Pacijentica je navela da tijekom prethodnih 12 mjeseci gotovo uopće nije napuštala obiteljski dom niti odlazila u kraće šetnje. Prema njezinu iskazu, razlog takvog ograničenja nije bila isključivo fizička sposobnost, već ponajprije psihološko stanje. Dugotrajna tjelesna neaktivnost, uz postojeće strukturne promjene lumbalne kralježnice i pridružene komorbiditete, mogla je biti povezana s perzistiranjem boli i izraženim ograničenjima funkcionalnog statusa.

Objektivnim pregledom procijenjene su funkcionalne sposobnosti i ograničenja pacijentice (Tablica 3.). Procjena je uključivala opservaciju posture, palpaciju miškulature te mjerenje mobilnosti lumbalne kralježnice. Funkcioniranje pacijentice dodatno je procijenjeno prema Međunarodnoj klasifikaciji funkcioniranja, onesposobljenosti i zdravlja (ICF), uključujući domene tjelesnih funkcija i struktura, aktivnosti i participacije te okolišne i osobne čimbenike. Na temelju rezultata početne procjene definirani su individualni fizioterapijski ciljevi i plan intervencije.

Fizioterapijska intervencija provedena je tijekom dva tjedna kroz ukupno deset individualnih tretmana. Intervencija je individualno prilagođena funkcionalnom statusu, simptomima i sposobnostima pacijentice, a temeljila se na primjeni proprioceptivne neuromuskularne facilitacije (PNF), uz edukaciju i individualno prilagođen program vježbi za samostalno provođenje kod kuće.

Po završetku fizioterapijskog procesa ponovljena je procjena, pri čemu je zabilježeno objektivno poboljšanje promatranih kliničkih i funkcionalnih pokazatelja (Tablica 4.). Pacijentica je bila sposobna samostalno obavljati kućanske aktivnosti bez značajnijeg ograničenja ili pogoršanja simptoma. Uz smanjenje intenziteta boli i povećanje razine tjelesne aktivnosti, pacijentica je navela poboljšanje subjektivnog psihološkog stanja i ponovno uključivanje u socijalne aktivnosti. Također je zabilježena

veća motivacija za nastavak tjelesne aktivnosti i samostalno provođenje naučenih vježbi.

Rezultati završne procjene upućuju na poboljšanje funkcionalnog statusa i aktivnosti pacijentice nakon provedenog dvotjednog individualiziranog fizioterapijskog programa temeljenog na PNF konceptu. S obzirom na prirodu prikaza slučaja i istodobnu primjenu edukacije i kućnog programa vježbi, opažene promjene nije moguće pripisati isključivo primjeni PNF-a.

Položaj glave	Protrakcija
Torakalna kralježnica	Naglašena kifoza
Rameni obruč	Unutarnja rotacija
Lumbalna kralježnica	Naglašena lordoza
Mobilnost kukova	Ograničena
Paravertebralna miškulatura	Povišen tonus duž cijele kralježnice, osobito lumbalno
Glutealna miškulatura	Hipotona
Trbušna miškulatura	Hipotona
Pokretljivost lumbalne kralježnice	Ograničena u svim smjerovima uz prisutnu bol pri kraju pokreta
Hod	Spor, nesiguran, kraći koraci

Tablica 3. Posturalna i funkcionalna procjena pacijentice

	Početak	Završetak
VAS u mirovanju	30/100 (uz analgetik)	40/100 (bez analgetika)
VAS u aktivnosti	90/100 (uz analgetik)	60/100 (bez analgetika)
Fleksija trupa	62cm (uz bol)	15cm (bez boli)
Laterofleksija u desno	65cm (uz bol)	52cm (bez boli)
Laterofleksija u lijevo	68cm (uz bol)	55cm (bez boli)

Tablica 4. Rezultati početne i završne fizioterapijske procjene pacijentice

RASPRAVA

Suvremeni rehabilitacijski pristup osobama s boli u lumbalnom dijelu kralježnice uključuje različite oblike terapijskog vježbanja, pri čemu se program intervencije individualno prilagođava kliničkom i funkcionalnom statusu te potrebama pacijenta. Proprioceptivnu neuromuskularnu facilitaciju (PNF) stoga ne treba promatrati kao pristup koji zamjenjuje druge oblike terapijskog vježbanja, već kao jednu od mogućnosti unutar individualiziranog fizioterapijskog procesa (2,4).

U prikazanom slučaju nakon dvotjednog individualiziranog fizioterapijskog programa temeljenog na PNF konceptu zabilježeni su smanjenje intenziteta boli, povećanje mobilnosti lumbalne kralježnice te poboljšanje funkcionalnog statusa i aktivnosti pacijentice. Pacijentica je nakon završetka intervencije ponovno bila sposobna obavljati aktivnosti svakodnevnog života te se uključivati u socijalne aktivnosti. Najizraženija promjena zabilježena je u intenzitetu boli tijekom aktivnosti, koji se na vizualnoj analognoj skali (VAS) smanjio s 90/100 na 60/100. Pri interpretaciji ovog rezultata potrebno je uzeti u obzir činjenicu da je početna procjena boli provedena uz primjenu analgetika, dok je završna procjena provedena bez analgetika, što otežava izravnu usporedbu dobivenih vrijednosti.

Rezultati prikazanog slučaja u skladu su s rezultatima sustavnog pregleda i meta-analize u kojima je utvrđeno da primjena PNF-a može imati povoljan učinak na smanjenje boli i funkcionalne onesposobljenosti kod osoba s kroničnom boli u lumbalnom dijelu kralježnice. Međutim, autori su kvalitetu dostupnih dokaza ocijenili niskom do umjerenom te naglasili potrebu za metodološki kvalitetnijim istraživanjima (10). Slično tome, meta-analiza Linga i suradnika pokazala je povoljne učinke PNF-a na bol i aktivnosti kod osoba s kroničnom lumbalnom boli, ali zbog malog broja uključenih randomiziranih kontroliranih istraživanja autori preporučuju oprez pri interpretaciji rezultata (11).

Potencijal PNF-a u smanjenju boli i poboljšanju funkcionalnog statusa pokazali su i Areeudomwong i Buttagat u randomiziranom kontroliranom istraživanju provedenom na 44 osobe s kroničnom lumbalnom boli. Sudionici su tijekom tri tjedna provodili PNF program ili standardni program vježbi za trup. U PNF skupini zabilježeni su smanjenje intenziteta boli i poboljšanje funkcionalne sposobnosti, međutim bez statistički značajne razlike u odnosu na skupinu koja je provodila standardne vježbe (12). Ovakvi rezultati dodatno upućuju na to da se PNF ne može smatrati superiornim drugim oblicima terapijskog vježbanja, ali može predstavljati jednu od mogućnosti u individualiziranom rehabilitacijskom pristupu.

Uz smanjenje boli, u prikazanom slučaju zabilježeno je i povećanje mobilnosti lumbalne kralježnice, što je predstavljalo jedan od primarnih ciljeva fizioterapijske intervencije. Slične rezultate navode Kofotolis i Kellis, koji su na uzorku od 86 žena s kroničnom lumbalnom boli ispitivali učinke dvaju PNF programa tijekom četiri tjedna. U obje ispitivane skupine zabilježeni su poboljšanje mobilnosti lumbalne kralježnice, povećanje izdržljivosti mišića trupa i poboljšanje funkcionalnog statusa (13). Mogući učinci PNF-a na funkciju mogu se povezati s primjenom funkcionalnih obrazaca pokreta i koordiniranom aktivacijom više mišićnih skupina tijekom izvođenja zadataka (7).

Povoljne promjene nakon PNF programa mogu se zadržati i nakon završetka intervencije. Mavromoustakos i suradnici usporedili su učinke šestotjednog PNF programa sa standardnim programom vježbanja kod osoba s kroničnom boli u lumbalnom dijelu kralježnice te su smanjenje intenziteta boli zabilježili i osam tjedana nakon završetka programa (14). U prikazanom slučaju praćenje nakon završetka dvotjedne intervencije nije provedeno, stoga nije moguće procijeniti održivost postignutih promjena.

Važan aspekt ovog prikaza slučaja predstavlja i promjena razine aktivnosti i participacije pacijentice. Prije početka fizioterapije pacijentica je zbog kombinacije boli, dugotrajne tjelesne neaktivnosti i psiholoških čimbenika bila izrazito ograničena u svakodnevnim i socijalnim aktivnostima. Nakon završetka intervencije navela je veću razinu tjelesne aktivnosti, ponovno obavljanje kućanskih poslova, povećanu motivaciju i ponovno uključivanje u socijalne aktivnosti. Međutim, zbog složenosti kliničke slike i istodobne prisutnosti brojnih čimbenika nije moguće navedene promjene pripisati isključivo primjeni PNF-a. Rezultate je prikladnije promatrati u kontekstu individualiziranog i holističkog fizioterapijskog pristupa koji je, osim PNF-a, uključivao edukaciju, kućni program vježbi i aktivno sudjelovanje pacijentice u rehabilitacijskom procesu.

Ovaj prikaz slučaja ima nekoliko metodoloških ograničenja. Prije svega, riječ je o pojedinačnom slučaju zbog čega rezultate nije moguće generalizirati na širu populaciju osoba s protruzijom intervertebralnog diska ili kroničnom lumbalnom boli. Intervencija je trajala dva tjedna, a izostanak naknadnog praćenja onemogućuje procjenu dugoročnog održavanja postignutih rezultata. Nadalje, mišićna snaga i izdržljivost nisu objektivno mjerene, zbog čega nije moguće donositi zaključke o promjenama tih parametara. Početna i završna procjena boli provedene su u različitim uvjetima s obzirom na primjenu analgetika, što predstavlja dodatno ograničenje pri interpretaciji promjene intenziteta boli. Također, intervencija nije uključivala isključivo PNF, već i edukaciju i kućni program vježbi, zbog čega nije moguće izdvojiti učinak

pojedine komponente terapijskog programa.

Unatoč navedenim ograničenjima, u prikazanom slučaju nakon provedenog individualiziranog fizioterapijskog programa zabilježena su poboljšanja boli, mobilnosti, funkcionalnog statusa, aktivnosti i participacije. Dobiiveni rezultati u skladu su s dosadašnjim istraživanjima koja upućuju na potencijalnu korist primjene PNF-a kod osoba s kroničnom boli u lumbalnom dijelu kralježnice (10–14).

ZAKLJUČAK

U prikazanom slučaju nakon dvotjednog individualiziranog fizioterapijskog programa temeljenog na PNF konceptu zabilježeni su smanjenje boli tijekom aktivnosti, povećanje mobilnosti lumbalne kralježnice te poboljšanje funkcionalnog statusa, aktivnosti i socijalne participacije pacijentice. S obzirom na složenost kliničke slike, prisutnost protruzija intervertebralnih diskova na više razina, pridruženih komorbiditeta, dugotrajne tjelesne neaktivnosti i psiholoških čimbenika, rezultati ovog prikaza slučaja naglašavaju važnost individualiziranog i holističkog pristupa tijekom fizioterapijskog procesa.

Dostupna literatura upućuje na potencijalne povoljne učinke PNF-a na bol, funkcionalnu sposobnost, mobilnost lumbalne kralježnice i izdržljivost mišića trupa, ali PNF ne treba promatrati kao izoliran ili superioran pristup u odnosu na druge oblike terapijskog vježbanja. Može predstavljati jednu od mogućnosti unutar individualiziranog rehabilitacijskog programa. Za pouzdaniju procjenu učinaka PNF-a potrebna su daljnja kvalitetna randomizirana kontrolirana istraživanja na većim uzorcima, uz primjenu standardiziranih objektivnih mjernih instrumenata i dugoročnije praćenje ispitanika.

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PULMONARY REHABILITATION AFTER IVOR LEWIS ESOPHAGECTOMY FOR END-STAGE ACHALASIA

Plućna rehabilitacija nakon Ivor Lewis ezofagektomije u bolesnice s krajnjim stadijem ahalazije

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ABSTRACT

Background: Achalasia is a rare primary esophageal motility disorder characterized by impaired lower esophageal sphincter relaxation and absent or impaired esophageal peristalsis. Progressive esophageal dilatation may result in severe dysphagia, recurrent aspiration, respiratory complications, and, in selected patients with end-stage disease, the need for esophagectomy.

Case Presentation: A 46-year-old woman with end-stage achalasia underwent subtotal Ivor Lewis esophagectomy with intrathoracic esophagogastric anastomosis after progressive dysphagia and recurrent aspiration pneumonia. Three months after surgery, she presented with persistent dry cough, hoarseness, impaired breathing pattern, postoperative pain, and markedly reduced exercise tolerance. Baseline physiotherapeutic assessment demonstrated inspiratory muscle weakness, reduced peripheral muscle strength, and decreased functional exercise capacity, whereas ultrasonographic examination confirmed preserved diaphragmatic function. The patient subsequently completed a seven-week individualized outpatient pulmonary rehabilitation program comprising breathing retraining, inspiratory muscle training, aerobic exercise, and progressive resistance training.

Results: Following rehabilitation, maximal inspiratory pressure increased from 46 to 75 cmH₂O (51% to 83% of the predicted value), the 6-minute walk distance improved from 403 to 555 m, and bilateral handgrip strength increased from 18 to 26 kg. The patient also reported marked reductions in cough, postoperative pain, and dyspnea during physical activity. Persistent hoarseness was subsequently attributed to unilateral vocal cord paresis, and speech therapy was initiated.

Conclusion: This case demonstrates that a comprehensive pulmonary rehabilitation program may substantially improve respiratory muscle performance, functional exercise capacity, peripheral muscle strength, and postoperative symptoms following esophagectomy for end-stage achalasia.

Keywords: achalasia; pulmonary rehabilitation; esophagectomy

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SAŽETAK

Uvod: Ahalazija je rijedak primarni poremećaj motiliteta jednjaka obilježen oslabljenom relaksacijom donjeg ezofagealnog sfinktera i odsutnom ili oštećenom peristaltikom jednjaka. Progresivna dilatacija jednjaka može dovesti do teške disfagije, čestih aspiracija, respiratornih komplikacija te, kod odabranih pacijenata u završnoj fazi bolesti, potrebe za ezofagektomijom.

Prikaz slučaja: Pacijentica u dobi od 46 godina sa završnom fazom ahalazije operirana je metodom subtotalne Ivor Lewisove ezofagektomije s intratorakalnom ezofagogastričnom anastomozom nakon progresivne disfagije i recidivirajuće aspiracijske pneumonije. Tri mjeseca nakon operacije, dolazi na pregled zbog perzistentnog suhog kašlja, promuklosti, nepravilnog obrasca disanja, postoperativne boli te izrazito smanjene tolerancije na fizičke napore. Početnom fizioterapijskom procjenom utvrđena je slabost inspiratornih mišića, smanjena snaga perifernih mišića i smanjeni funkcionalni kapacitet vježbanja, dok je ultrazvučni pregled potvrdio očuvanu funkciju ošita. Pacijentica je nakon toga provela sedmotjedni individualizirani izvanbolnički program plućne rehabilitacije koji je obuhvaćao respiratornu reedukaciju, trening inspiratornih mišića, aerobne vježbe i progresivni trening snage.

Rezultati: Nakon rehabilitacije, maksimalni inspiratorni tlak porastao je s 46 na 75 cmH₂O (s 51% na 83% predviđene vrijednosti), udaljenost u šestominutnom testu hoda poboljšala se s 403 na 555 m, a obostrana snaga stiska šake porasla je s 18 na 26 kg. Pacijentica je također prijavila izrazito smanjenje kašlja, postoperativne boli i dispneje tijekom fizičke aktivnosti. Perzistentna promuklost naknadno je pripisana jednostranoj parezi glasnica te je započeta logopedska terapija.

Zaključak: Ovaj slučaj pokazuje da sveobuhvatni program plućne rehabilitacije može značajno poboljšati funkciju respiratornih mišića, funkcionalni kapacitet vježbanja, snagu perifernih mišića i smanjiti postoperativne simptome nakon ezofagektomije zbog završne faze ahalazije.

Ključne riječi: ahalazija; plućna rehabilitacija; ezofagektomija

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INTRODUCTION

Achalasia is a rare primary esophageal motility disorder characterized by impaired relaxation of the lower esophageal sphincter and absent or severely impaired esophageal peristalsis, resulting in progressive esophageal dilatation and dysphagia. In advanced stages, chronic retention of food and secretions within the esophagus predisposes patients to recurrent aspiration and respiratory complications, which may substantially contribute to morbidity and impaired quality of life (1).

The annual incidence of achalasia is approximately 1.6 cases per 100,000 individuals, with an estimated prevalence of 10 cases per 100,000. The disease affects men and women equally and may occur at any age, although the highest incidence is observed between the third and sixth decades of life (1,2,3).

Patients typically present with progressive dysphagia, regurgitation, and chest discomfort, whereas advanced disease may be complicated by recurrent aspiration pneumonia and significant esophageal dilatation.

The diagnosis is established using upper gastrointestinal endoscopy, high-resolution esophageal manometry, endoscopic ultrasonography when indicated, and computed tomography to exclude secondary causes of esophageal obstruction (4,5).

Treatment depends on disease severity and aims to improve esophageal emptying by reducing lower esophageal sphincter pressure. Early-stage disease is generally managed with less invasive approaches, including pneumatic dilation and peroral endoscopic myotomy (POEM). In patients with end-stage achalasia, characterized by irreversible esophageal dilatation and failure of previous therapeutic interventions, esophagectomy may represent the most appropriate treatment option. Among the available surgical techniques, Ivor Lewis esophagectomy remains one of the standard procedures for carefully selected patients (5).

The aim of this case report was to describe the effects of a comprehensive pulmonary rehabilitation program in

a patient who underwent Ivor Lewis esophagectomy for end-stage achalasia and subsequently developed persistent respiratory symptoms, dysphonia, and reduced exercise tolerance.

CASE PRESENTATION

A 46-year-old woman was diagnosed with achalasia in 2023 after presenting with progressive dysphagia, exertional dyspnea, and recurrent febrile episodes associated with aspiration pneumonia. Chest computed tomography (CT) demonstrated marked esophageal dilatation with retained intraluminal contents and bilateral ground-glass opacities consistent with recurrent aspiration. Flexible bronchoscopy revealed multinucleated giant cells, raising initial suspicion of sarcoidosis, for which corticosteroid therapy was initiated. However, sarcoidosis was subsequently excluded following further diagnostic evaluation. As the disease progressed, dysphagia became the predominant symptom, leading to the diagnosis of end-stage achalasia.

Because of advanced disease and severe impairment of esophageal function, the patient underwent subtotal Ivor Lewis esophagectomy with intrathoracic gastric transposition and esophagogastric anastomosis in October 2025. The postoperative course was uneventful with respect to surgical complications; however, persistent respiratory and functional symptoms became evident during recovery. Three months after surgery, the patient continued to experience dry cough, hoarseness, postoperative thoracoabdominal pain, dyspnea during low-intensity physical activity, and markedly reduced exercise tolerance. Owing to these persistent symptoms, she was referred by her pulmonologist to an outpatient pulmonary rehabilitation program in January 2026.

A comprehensive physiotherapeutic assessment was performed before initiating rehabilitation. Clinical examination revealed a predominantly apical breathing pattern with excessive activation of accessory inspiratory muscles. Attempts to activate diaphragmatic breathing provoked pain originating in the xiphoid region and radiating bilaterally along the costal margins. Inspection demonstrated a healed midline abdominal scar extending from the xiphoid process to the umbilicus and a right posterolateral thoracotomy scar extending from the lateral border of the scapula toward the right breast. The patient reported an inability to achieve deep inspiration and developed tachypnea and dizziness even during low-intensity exercise.

Inspiratory muscle strength was assessed using a POWERbreathe device by measuring maximal inspiratory pressure (MIP), defined as the highest value obtained from three maximal inspiratory efforts. Peripheral muscle strength was evaluated using a Saehan SH5001 hydraulic

hand dynamometer, with the best of three measurements recorded for each hand. Functional exercise capacity was assessed using the 6-minute walk test (6MWT) according to European Respiratory Society recommendations (6,7).

Baseline assessment demonstrated reduced inspiratory muscle strength (MIP 46 cmH₂O; 51% predicted), impaired functional exercise capacity (6MWT 403 m; 69% predicted), and decreased bilateral handgrip strength (18 kg in both hands). During the initial 6MWT, the patient was unable to complete the test without interruption and required a pause between 2:57 and 4:08 minutes because of severe dyspnea (modified Borg score 8).

Given the extent of the thoracoabdominal procedure, diaphragmatic function was additionally assessed by ultrasonography using a Mindray e5Ms ultrasound system. Diaphragm thickness at end-expiration (TD_{min}) and at end-inspiration (TD_{max}) was measured in B-mode through a right intercostal approach with the patient in the supine position. These measurements were then used to calculate the diaphragm thickening fraction (DTF). Diaphragmatic excursion during deep breathing was subsequently assessed through a right subcostal approach with the patient in the supine position using M-mode ultrasonography (6,8). Baseline measurements demonstrated a diaphragm thickness of 1.6 mm at end-expiration (TD_{min}) and 2.6 mm at end-inspiration (TD_{max}), corresponding to a diaphragm thickening fraction of 62%. Diaphragmatic excursion during deep breathing measured 7.0 cm, indicating preserved diaphragmatic contractility and mobility. Clinically, these results are relevant given that phrenic nerve injury and diaphragmatic dysfunction frequently follow major thoracoabdominal surgery and complicate respiratory recovery (9).

An individualized outpatient pulmonary rehabilitation program was subsequently initiated and continued for seven weeks, comprising three supervised sessions per week. The rehabilitation protocol included breathing retraining focused on restoring diaphragmatic breathing and reducing respiratory rate, progressive resistance training for upper and lower extremity muscles using free weights and elastic resistance bands, and aerobic exercise on a cycle ergometer performed for 20 minutes at an individualized workload ranging from 75 to 125 W. Daily inspiratory muscle training was performed using a POWERbreathe Medic Plus® device. The patient completed 30 inspiratory efforts once daily against a resistance of 20 cmH₂O during the first two weeks, which was progressively increased to 40 cmH₂O during the remaining five weeks according to individual tolerance and clinical progression. During the early phase of rehabilitation, breathing retraining represented the greatest challenge because of pronounced accessory inspiratory muscle recruitment and difficulty in maintaining diaphragmatic breathing during exercise.

Following completion of the rehabilitation program, clinically meaningful improvements were observed across all functional outcomes. Maximal inspiratory pressure increased from 46 to 75 cmH₂O, corresponding to an improvement from 51% to 83% of the predicted value. Functional exercise capacity improved substantially, with the 6-minute walk distance increasing from 403 to 555 m (69% to 95% predicted). Bilateral handgrip strength increased from 18 to 26 kg. In parallel with these objective findings, the patient reported a marked reduction in dry cough, improved breathing efficiency, decreased postoperative pain, and greater tolerance of daily physical activities.

Despite these favorable outcomes, persistent hoarseness and a breathy voice remained. Subsequent otolaryngological evaluation confirmed unilateral vocal cord paresis, and the patient was referred for speech and language therapy.

Ethical considerations

According to institutional and national regulations, formal ethical approval was not required because this report represents a non-interventional retrospective case report based solely on fully anonymised data obtained from routine physiotherapy documentation and medical records, without any additional interventions or prospective data collection performed for research purposes.

DISCUSSION

In this case report, we describe the successful rehabilitation of a patient who developed persistent respiratory symptoms, impaired exercise tolerance, and dysphonia following Ivor Lewis esophagectomy performed for end-stage achalasia. After completing a seven-week individualized pulmonary rehabilitation program, the patient demonstrated clinically meaningful improvements in inspiratory muscle strength, peripheral muscle strength, functional exercise capacity, postoperative pain, and respiratory symptoms. These findings suggest that pulmonary rehabilitation may represent an important component of postoperative management in carefully selected patients following esophagectomy.

A review of the available literature revealed a remarkable lack of studies specifically addressing postoperative pulmonary rehabilitation following esophagectomy for achalasia. This is not unexpected, as esophagectomy is reserved for a relatively small proportion of patients with end-stage disease. Although the procedure is considered safe and effective in appropriately selected patients, it is generally indicated only when severe esophageal dilatation and functional deterioration persist despite previous therapeutic interventions (10). In current clinical practice, less invasive treatment modalities are preferred

whenever feasible, whereas esophagectomy is reserved for patients in whom these interventions have failed or are no longer appropriate. Howard et al. described two patients with end-stage achalasia in whom less invasive treatment approaches, including pneumatic dilation and surgical myotomy, failed to achieve satisfactory symptom control. Consequently, open esophagectomy was performed, resulting in complete symptom resolution and a substantial improvement in quality of life (11).

Although evidence regarding esophagectomy for achalasia is limited, pulmonary complications following esophagectomy have been extensively investigated in patients with esophageal cancer. Regardless of the underlying indication for surgery, the mechanisms responsible for postoperative respiratory impairment are largely comparable. Respiratory complications may include atelectasis, pneumonia, acute respiratory distress syndrome, pleural effusion, pneumothorax, mucus retention, aspiration, tracheobronchial injury, and respiratory failure (12).

Another important postoperative complication is recurrent laryngeal nerve injury, which may result in vocal cord paralysis, dysphonia, impaired airway protection, and an increased risk of aspiration. Seesing et al. reported that approximately 25% of patients with recurrent laryngeal nerve paralysis require vocal cord surgery within the first postoperative year (13). In our patient, persistent hoarseness remained despite significant improvement in respiratory function and was ultimately attributed to unilateral vocal cord paresis confirmed by otolaryngological evaluation. Although pulmonary rehabilitation could not reverse the neurological deficit, improved respiratory muscle performance and breathing efficiency likely contributed to better overall functional recovery before speech therapy was initiated.

Several strategies have been proposed to reduce postoperative pulmonary morbidity after esophagectomy. Edmondson et al. emphasized the importance of preoperative pulmonary optimization, including breathing exercises, coughing techniques, inspiratory muscle training, incentive spirometry, and pharmacological measures aimed at improving secretion clearance (12). Likewise, Yoshida et al. highlighted the benefits of smoking cessation, nutritional optimization, meticulous oral hygiene, minimally invasive surgical techniques whenever feasible, perioperative corticosteroid administration, and multidisciplinary perioperative care (14). While these strategies primarily focus on reducing the incidence of postoperative pulmonary complications, our findings suggest that patients with persistent respiratory impairment after surgery may also benefit substantially from a structured postoperative pulmonary rehabilitation program.

Appropriate identification of patients at increased risk of postoperative pulmonary complications remains an important aspect of perioperative management. Ferguson et al. identified advanced age, reduced forced expiratory volume in one second (FEV₁), impaired diffusing capacity for carbon monoxide (DLCO), poor performance status, elevated serum creatinine levels, active smoking, and transthoracic surgical approach as independent predictors of major pulmonary complications (15).

The clinical importance of preventing pulmonary complications extends beyond the immediate postoperative period. Manara et al. demonstrated that patients undergoing esophagectomy for esophageal cancer who remained free of postoperative pulmonary complications had significantly better overall survival, cancer-specific survival, and disease-free survival than those who developed pulmonary complications (16). Although these findings originate from an oncological population, they further emphasize the importance of preserving postoperative respiratory function and minimizing pulmonary morbidity whenever possible.

Our case suggests that pulmonary rehabilitation may support recovery through several complementary mechanisms, including optimization of breathing patterns, improvement of inspiratory muscle performance, restoration of peripheral muscle strength, and enhancement of functional exercise capacity. Improvements in objective functional outcomes, together with reductions in patient-reported symptoms, suggest a potential clinical role for comprehensive pulmonary rehabilitation following esophagectomy for end-stage achalasia. However, given the single-case design and the absence of a control condition, the observed improvements cannot be attributed exclusively to the rehabilitation intervention. Spontaneous postoperative recovery and other factors related to the natural course of recovery may also have contributed to the favorable outcomes. Therefore, these findings should be interpreted cautiously and considered primarily as supportive evidence for the feasibility and potential benefit of pulmonary rehabilitation in this specific clinical context.

CONCLUSION

This case report demonstrates that a comprehensive, individualized pulmonary rehabilitation program may substantially improve postoperative recovery following Ivor Lewis esophagectomy for end-stage achalasia. After seven weeks of rehabilitation, the patient showed clinically meaningful improvements in inspiratory muscle strength, peripheral muscle strength, functional exercise capacity, breathing pattern, and postoperative symptoms, accompanied by normalization of pulmonary function parameters. Although vocal cord paresis persisted

and required subsequent speech therapy, pulmonary rehabilitation contributed to significant functional recovery and improved overall respiratory performance.

Given the limited evidence regarding postoperative rehabilitation in patients undergoing esophagectomy for achalasia, this case highlights the potential value of incorporating pulmonary rehabilitation into routine multidisciplinary postoperative care. Early assessment of respiratory function and timely initiation of individualized rehabilitation may facilitate recovery, reduce postoperative disability, and improve patients' functional status and quality of life. Further prospective studies are needed to establish standardized rehabilitation protocols and to determine their long-term effects on respiratory outcomes, exercise capacity, and health-related quality of life.

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