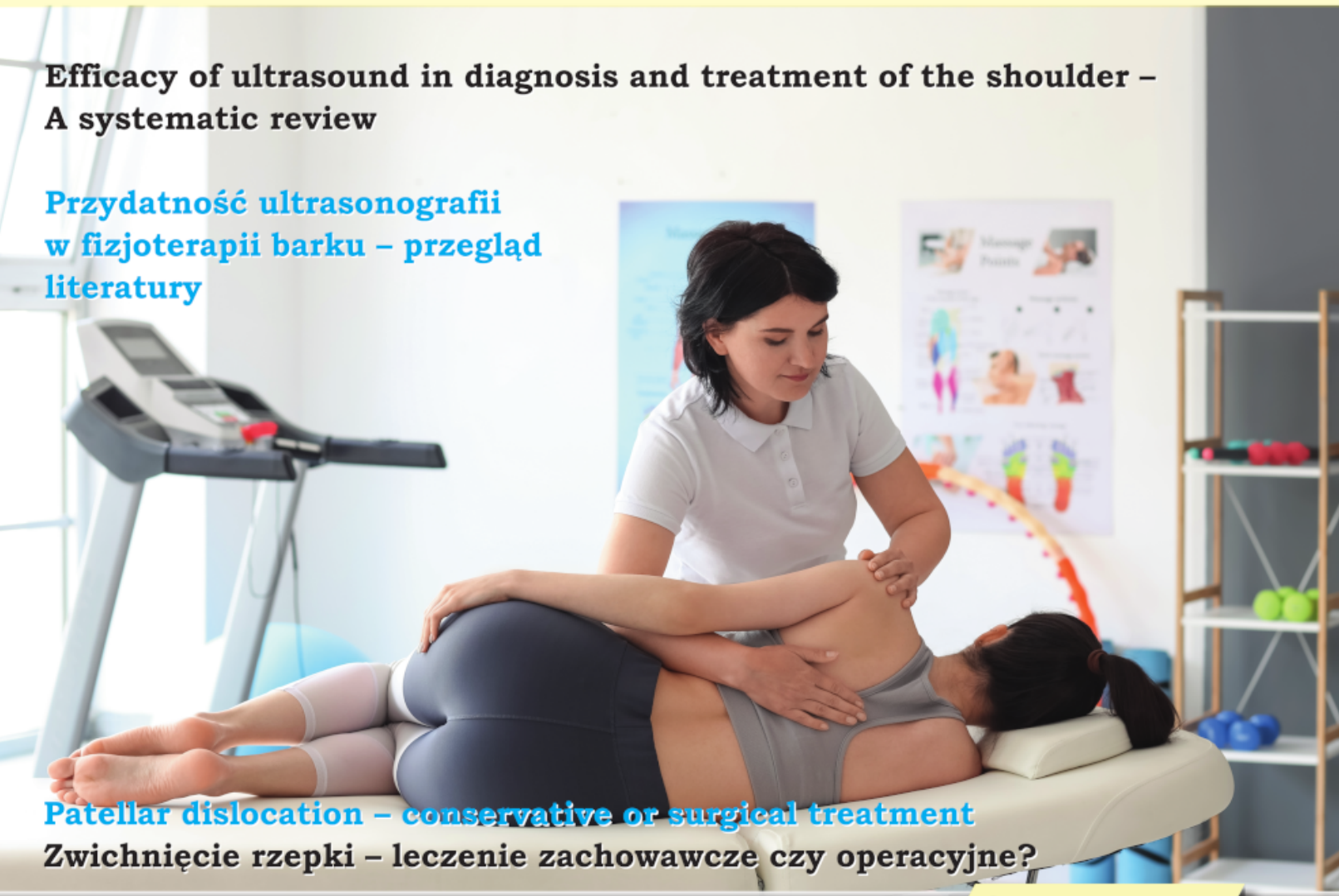
fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 4/2022 (22) DWUMIESIĘCZNIK ISSN 1642-0136



Efficacy of ultrasound in diagnosis and treatment of the shoulder – A systematic review

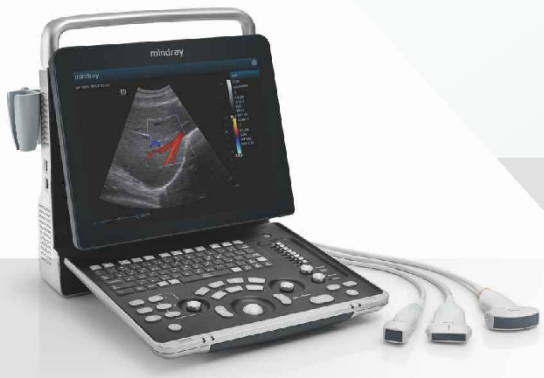
Przydatność ultrasonografii w fizjoterapii barku – przegląd literatury

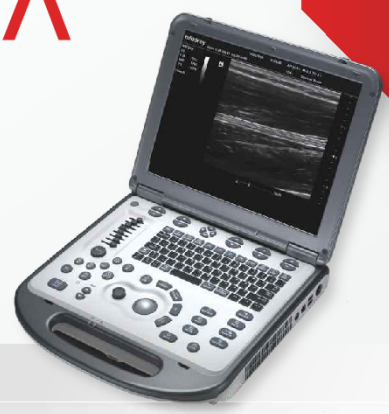
Patellar dislocation – conservative or surgical treatment

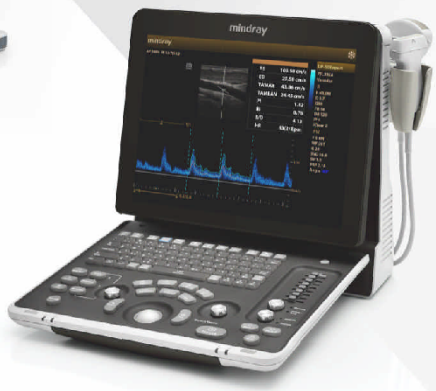
Zwichnięcie rzepki – leczenie zachowawcze czy operacyjne?

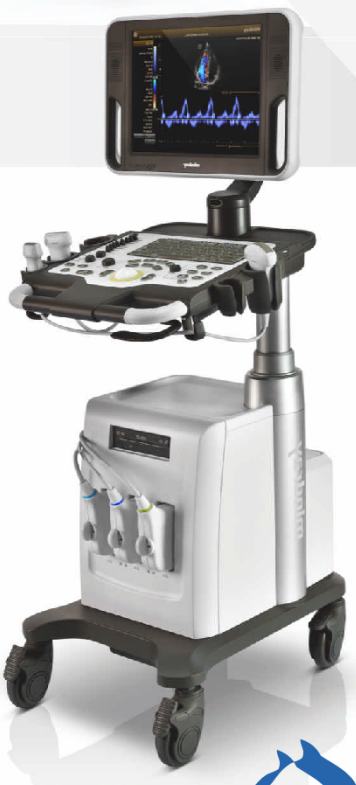
mindray
healthcare within reach

ULTRASONOGRAFIA W FIZJOTERAPII









Autoryzowani dystrybutorzy

Mar-Med

+48 22 853 14 11

info@mar-med.pl

Ado-Med

+48 32 770 68 29

adomed@adomed.pl

MAR-MED
OD 1995 ROKU

ADO-MED®
APARATURA MEDYCZNA

Zawód Fizjoterapeuty dobrze chroniony

Poczuj się bezpiecznie

INTER Fizjoterapeuci
Dedykowany Pakiet Ubezpieczeń

Zaufaj rozwiązaniom sprawdzonym w branży medycznej.
Wykup dedykowany pakiet ubezpieczeń INTER Fizjoterapeuci, który zapewni Ci:

- ochronę finansową na wypadek roszczeń pacjentów – NOWE UBEZPIECZENIE OBOWIĄZKOWE OC
- ubezpieczenie wynajmowanego sprzętu fizjoterapeutycznego
- profesjonalną pomoc radców prawnych i zwrot kosztów obsługi prawnej
- odszkodowanie w przypadku fizycznej agresji pacjenta
- ochronę finansową związaną z naruszeniem praw pacjenta
- odszkodowanie w przypadku nieszczęśliwego wypadku

Nasza oferta była konsultowana ze stowarzyszeniami zrzeszającymi fizjoterapeutów tak, aby najskuteczniej chronić i wspierać Ciebie oraz Twoich pacjentów.

► Skontaktuj się ze swoim agentem i skorzystaj z wyjątkowej oferty!

Towarzystwo Ubezpieczeń INTER Polska S.A.
Al. Jerozolimskie 142 B
02-305 Warszawa

www.interpolska.pl

inter UBEZPIECZENIA

KALMED
Iwona Renz, Poznań

ARTROMOT®
WYŁĄCZNY PRZEDSTAWICIEL
WWW.KALMED.COM.PL

DJO GLOBAL

SPRZEDAŻ I WYPOŻYCZALNIA ZMOTORYZOWANYCH SZYN CPM ARTROMOT®

Nowoczesna rehabilitacja CPM stawu kolanowego, biodrowego, łokciowego, barkowego, skokowego, nadgarstka oraz stawów palców dłoni i kciuka.

ARTROMOT-H

ARTROMOT-F

ARTROSTIM
FOCUS PLUS

ARTROMOT-K1 ARTROMOT-SP3 ARTROMOT-S3 ARTROMOT-E2

Najnowsze konstrukcje ARTROMOT zapewniają ruch bierny stawów w zgodzie z koncepcją PNF (Proprioceptive Neuromuscular Facilitation).

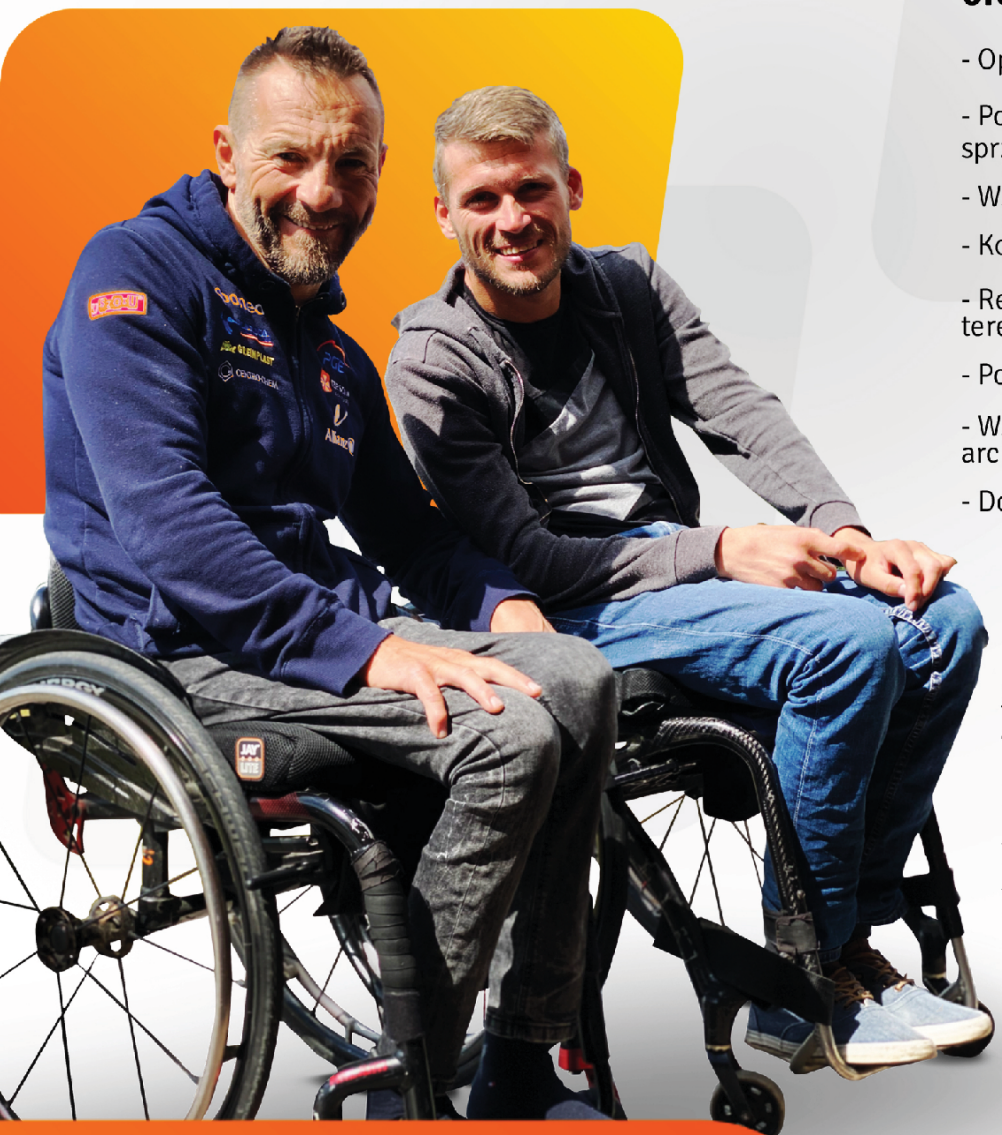
KALMED Iwona Renz
ul. Wilczak 3
61-623 Poznań
www.kalmed.com.pl

tel. 61 828 06 86
faks 61 828 06 87
kom. 601 64 02 23, 601 647 877
kalmed@kalmed.com.pl

Serwis i całodobowa
pomoc techniczna:
tel. 501 483 637
service@kalmed.com.pl

AKTYWIZACJA OSÓB PO URAZACH RDZENIA

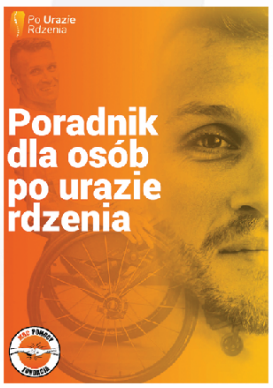
Po Urazie Rdzenia to ogólnopolski projekt skierowany do osób, które doznały urazu rdzenia kręgowego. Jego celem jest wielopłaszczyznowe wsparcie na drodze do odzyskania możliwie największej sprawności.



W ramach programu oferujemy pacjentom:

- Opiekę Menadżera Rehabilitacji
- Pozyskanie funduszy na rehabilitację i zakup sprzętu
- Wsparcie psychologiczne
- Konsultacje specjalistów
- Rehabilitację neurologiczną w ośrodkach na terenie kraju
- Pomoc w doborze zaopatrzenia
- Wsparcie w likwidacji barier architektonicznych
- Doradztwo zawodowe

Skontaktuj się z nami i zapytaj o bezpłatne egzemplarze Poradnika dla osób po urazie rdzenia do Twojej placówki



Masz pytanie odnośnie programu. Napisz do nas lub skontaktuj się telefonicznie z naszymi menadżerami rehabilitacji:

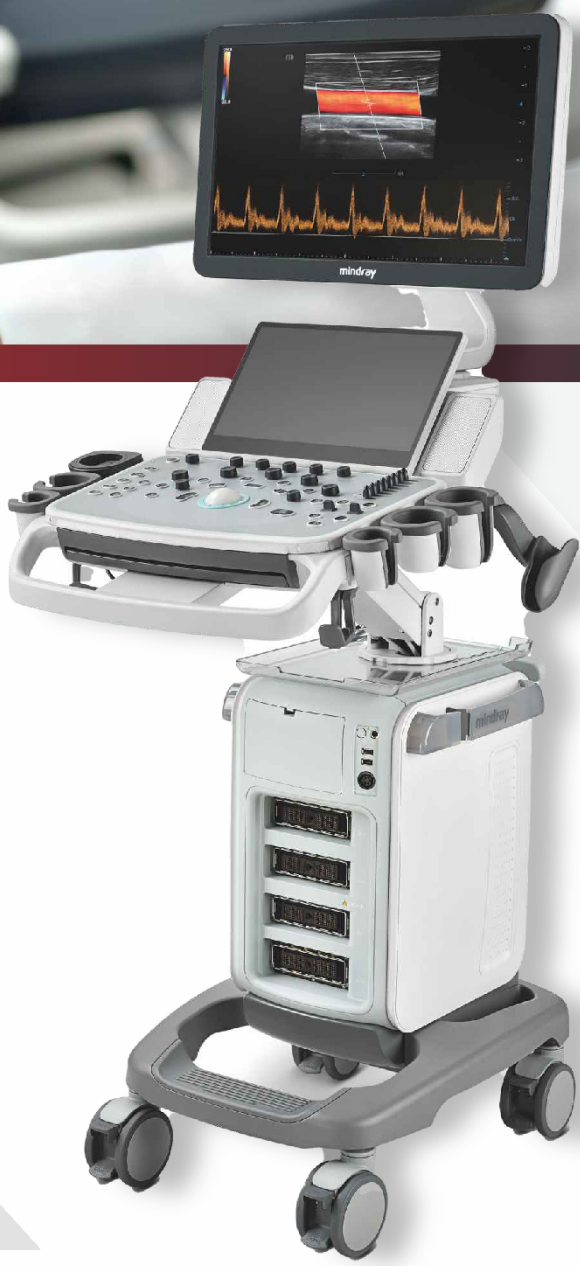
+48 881 035 005
lub +48 793 003 695
biuro@pourazierdzenia.pl
www.pourazierdzenia.pl

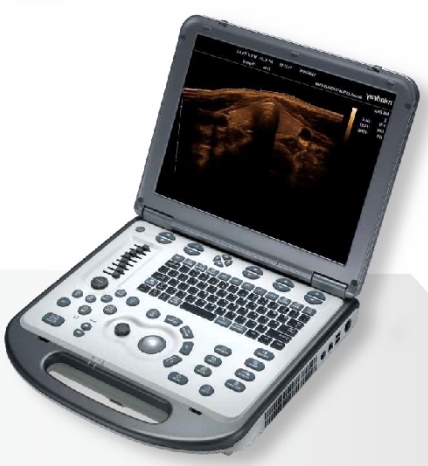
Po Urazie Rdzenia

mindray
healthcare within reach

ULTRASONOGRAFIA

W FIZJOTERAPII





Autoryzowani dystrybutorzy

Mar-Med

+48 22 853 14 11

info@mar-med.pl

Ado-Med

+48 32 770 68 29

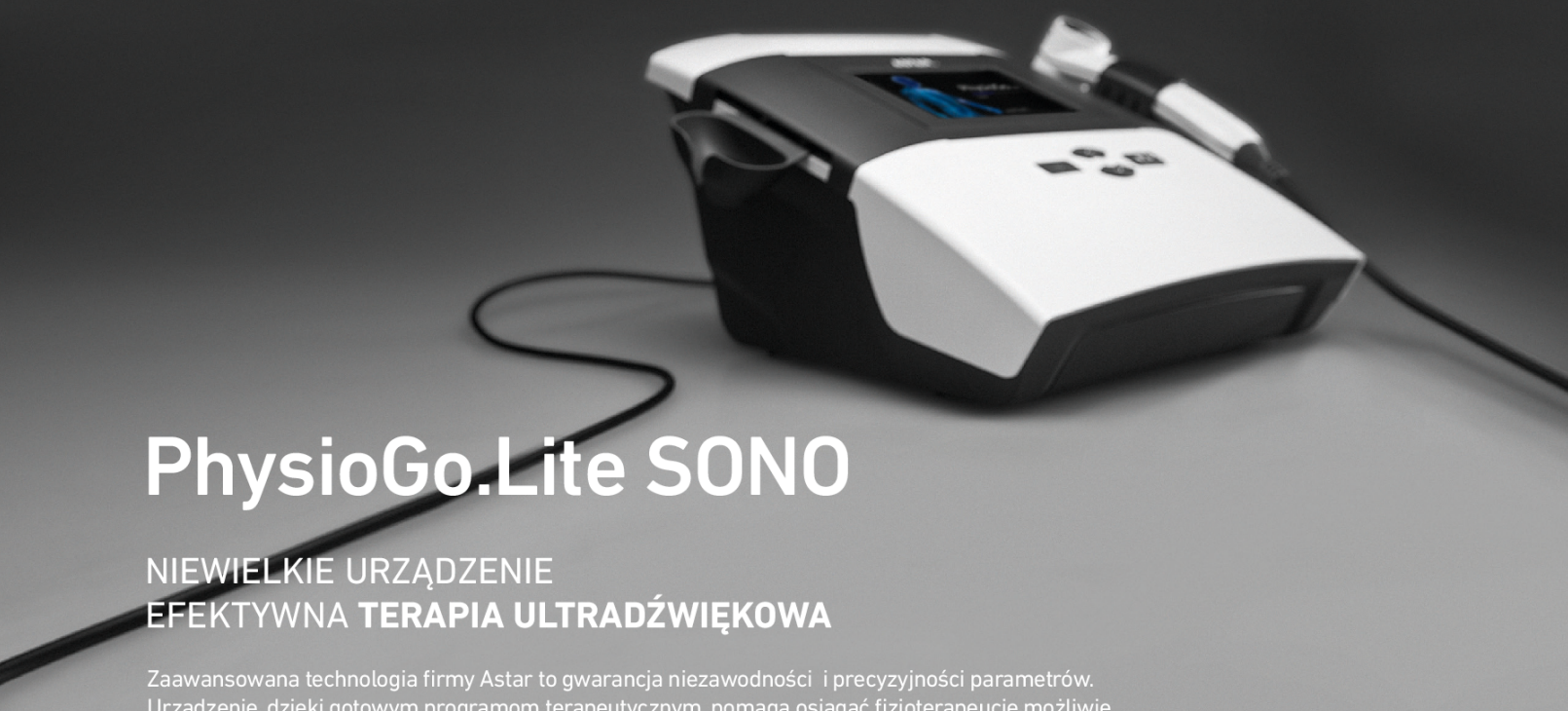
adomed@adomed.pl

MAR-MED
OD 1995 ROKU

ADO-MED®
APARATURA MEDYCZNA

NOWOŚĆ W OFERCIE

ASTAR.



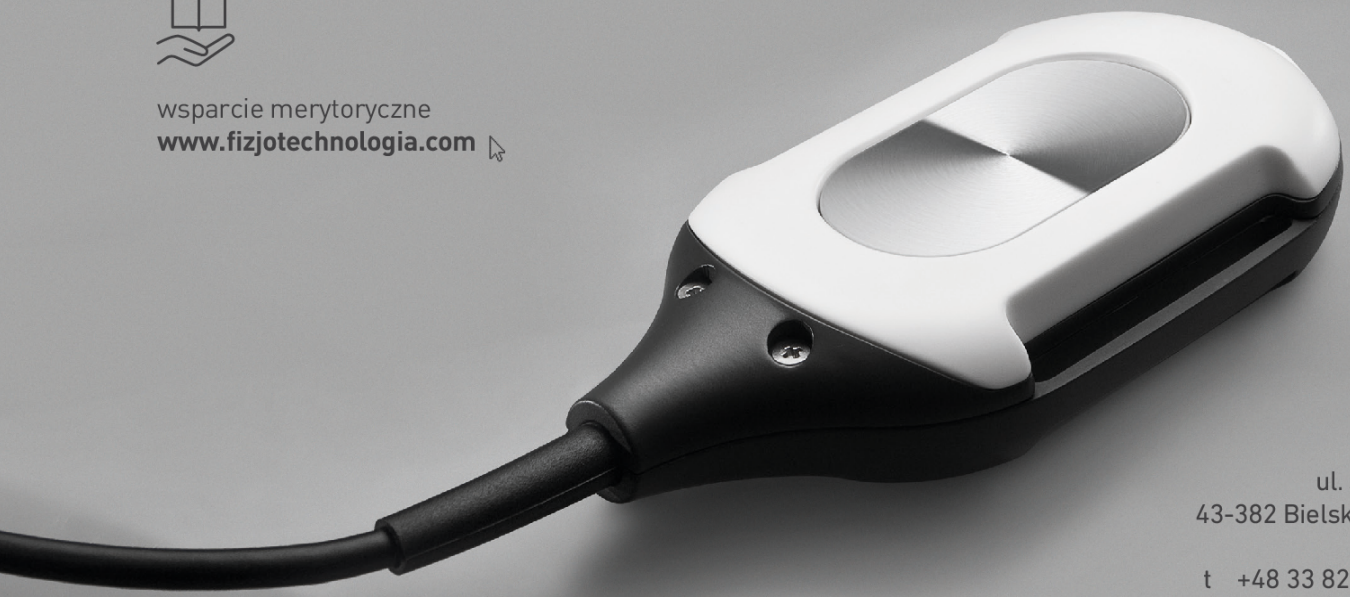
PhysioGo.Lite SONO

NIEWIELKIE URZĄDZENIE
EFEKTYWNA **TERAPIA ULTRADŹWIĘKOWA**

Zaawansowana technologia firmy Astar to gwarancja niezawodności i precyzyjności parametrów. Urządzenie, dzięki gotowym programom terapeutycznym, pomaga osiągać fizjoterapeucie możliwie najlepsze efekty działania fal ultradźwiękowych.

Głowica SnG to bezobsługowe akcesorium o dużej powierzchni czoła (17,3 cm^2 lub 34,5 cm^2 w zależności od wybranego trybu działania). Znajduje zastosowanie w klasycznej terapii ultradźwiękami, fonoferezie, terapii LIPUS i zabiegach skojarzonych (w połączeniu z elektroterapią).

wsparcie merytoryczne
www.fizjotechnologia.com



ul. Świt 33
43-382 Bielsko-Biała

t +48 33 829 24 40
astarmed@astar.eu

www.astar.pl

POLSKI PRODUKT WYBIERASZ I WSPIERASZ

Dr. Comfort®

Nowy wymiar wygody.

Obuwie profilaktyczno-zdrowotne o atrakcyjnym wzornictwie

NAGRODA POLSKIEGO TOWARZYSTWA REHABILITACJI

ACCEPTED
AMERICAN PODIATRIC MEDICAL ASSOCIATION

APROBATA AMERYKAŃSKIEGO MEDYCZNEGO STOWARZYSZENIA PODIATRYCZNEGO

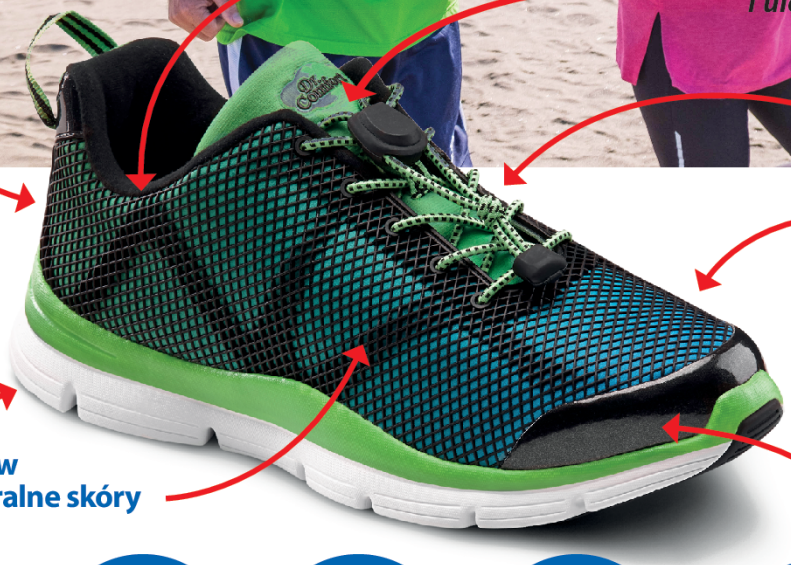
CE WYRÓB MEDYCZNY

Miękki, wyścielany kołnierz cholewki
Minimalizuje podrażnienia

Stabilny, wzmocniony i wyścielany zapiętek
Zapewnia silniejsze wsparcie łuku podłużnego stopy

Wyścielany język
Zmniejsza tarcie i ulepsza dopasowanie

Lekka konstrukcja
Zmniejsza codzienne zmęczenie



Antypoślizgowa, wytrzymała podeszwa o lekkiej konstrukcji
Zwiększa przyczepność, amortyzuje i odciąża stopy

Zwiększona szerokość i głębokość w obrębie palców i przodostopia
Minimalizuje ucisk i zapobiega urazom

Wysoka jakkość materiałów - oddychające siatki i naturalne skóry
Dostosowują się do stopy, utrzymują je w suchości i zapobiegają przegrzewaniu

Ochronna przestrzeń na palce - brak szwów w rejonie przodostopia
Minimalizuje możliwość zranień

Trzy rozmiary szerokości

Podwyższona tęgość

Zwiększona przestrzeń na palce

WSKAZANIA

• haluksy • wkładki specjalistyczne • palce młotkowate, szponiaste • cukrzyca (stopa cukrzycowa) • reumatoidalne zapalenie stawów • bóle pięty i podeszwy stopy (zapalenie rozcięgna podeszwowego - ostroga piętowa) • płaskostopie (stopa poprzecznie płaska) • bóle pleców • wysokie podbicie • praca stojąca • nerwiak Mortona • obrzęk limfatyczny • opatrunki • ortezy i bandaże • obrzęki • modzele • protezy • odciski • urazy wpływające na ścięgna, mięśnie i kości (np. ścięgno Achillesa) • wrastające paznokcie

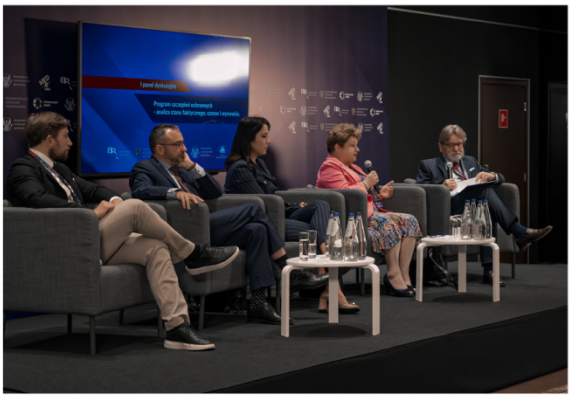
KALMED
Iwona Renz, Poznań

ul. Wilczak 3
61-623 Poznań
tel. 61 828 06 86
fax. 61 828 06 87
kom. 601 640 223, 601 647 877
e-mail: kalmed@kalmed.com.pl
www.kalmed.com.pl

www.butydlazdrowia.pl

www.dr-comfort.pl

Sukces czy porażka? Czyli jak wygląda sytuacja w zakresie szczepień ochronnych w Polsce?



Cztery uczelnie – Centrum Medyczne Kształcenia Podyplomowego, Warszawski Uniwersytet Medyczny, Akademia Leona Koźmińskiego i Uniwersytet SWPS zorganizowały konferencję naukową w ramach Projektu „Budowanie zaufania do szczepień ochronnych z wykorzystaniem najnowszych narzędzi komunikacji i wpływu społecznego".

Podczas czterech paneli dyskusyjnych eksperci, naukowcy, lekarze, psycholodzy, przedstawiciele instytucji publicznych dyskutowali na temat szans i wyzwań stojących przed system szczepień w Polsce.

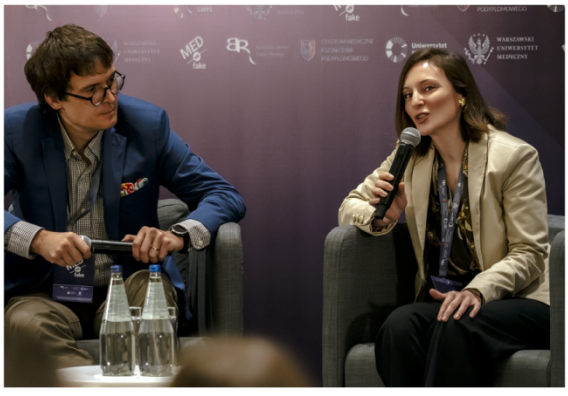
Nie da się zaprzeczyć faktom – szczepienia ochronne są najefektywniejszą metodą zwalczania chorób zakaźnych. Podnoszenie zaufania do szczepień, które przekłada się na poziom wyszczepienia populacji, jest więc kluczowym wyzwaniem stojącym przed wszystkim odpowiedzialnymi za zdrowie publiczne w Polsce.

Dużym sukcesem i krokiem w dobrym kierunku było wprowadzenie szczepień w aptekach – podkreślił prof. Jarosław Pinkas, Konsultant Krajowy w dziedzinie zdrowia publicznego.

Niemniej, mimo szeroko prowadzonej kampanii medialnej, Polska należy do krajów o najniższym poziomie wszczepienia przeciw COVID-19 w Europie (niespełna 60% populacji zostało w pełni zaszczepionych). Co roku w naszym kraju przeciw wirusowi grypy szczepi się jedynie 4-6% osób. Według danych PZH-NIPZ liczba uchyleń od szczepień obowiązkowych wśród dzieci w okresie od 2016 do 2020 roku wzrosła 2-krotnie z 23 tys. do 50.5 tys.

„Szczepienia przeciwko grypie u pracodawców bardzo zmniejszają absencję w pracy, ta sama prawidłowość dotyczy szczepień rotawirusowych" – mówił prof. Marcin Czech

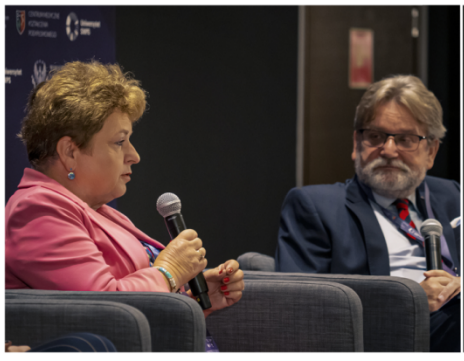
Z danych uzyskanych przez Warszawski Uniwersytet Medyczny wynika, że postawy mieszkańców Polski wobec szczepień nie są spójne. Może to w przyszłości spowodować dalszy spadek poziomu wyszczepienia populacji, a w dalszej perspektywie wzrost zagrożenia epidemiologicznego.

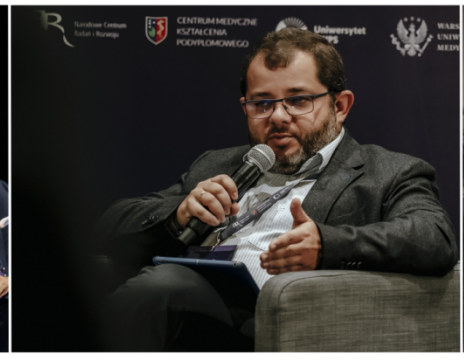


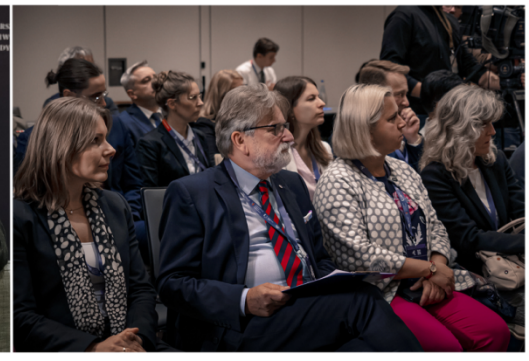
W ramach panelu prowadzonego przez Uniwersytet SWPS zastanawiano się nad przyczynami postaw wobec szczepień. Pierwszym skojarzeniem, jakie większość Polaków wypowiada po haśle „szczepienia" jest „koronawirus". I choć rzeczywiście od końca 2020 roku szczepienia przeciwko COVID-19 stały się jednym z bardzo ważnych elementów debaty publicznej, to przecież rosnąca liczba osób uchylających się od szczepień na takie choroby jak odra czy krztusiec była ważną kwestią społeczną już przed marcem 2020 roku.

Jednym z kluczowych wyzwań stojących przed system szczepień w Polsce jest walka z fake newsami, podkreślali eksperci Akademii Leona Koźmińskiego.
Czy dezinformację naukową można interpretować w kategoriach cyberwojny?
Czy jest to zagrożenie porównywalne z katastrofą klimatyczną, bądź rozwojem technik AI? Jaką rolę odgrywają w tym procesie media społecznościowe? To pytania z którymi musimy się jak najszybciej zmierzyć.

Mimo wszystko wysoka wyszczepialność w Polsce to sukces wszystkich profesjonalistów medycznych i osób działających na rzecz zdrowia publicznego. Wciąż zdecydowana większość Polaków dokonuje właściwych wyborów zdrowotnych. To optymistyczny wniosek płynący z konferencji CMKP, WUM, SWPS i ALK. Jednak nic nie jest dane raz na zawsze – pojawiające się wyzwania powinny mobilizować lekarzy, naukowców, edukatorów, przedstawicieli administracji publicznej do szukania nowych sposobów dotarcia z komunikatem zachęcającym do szczepień i podejmowania zdecydowanych działań na rzecz walki z dezinformacją.







MATIO®

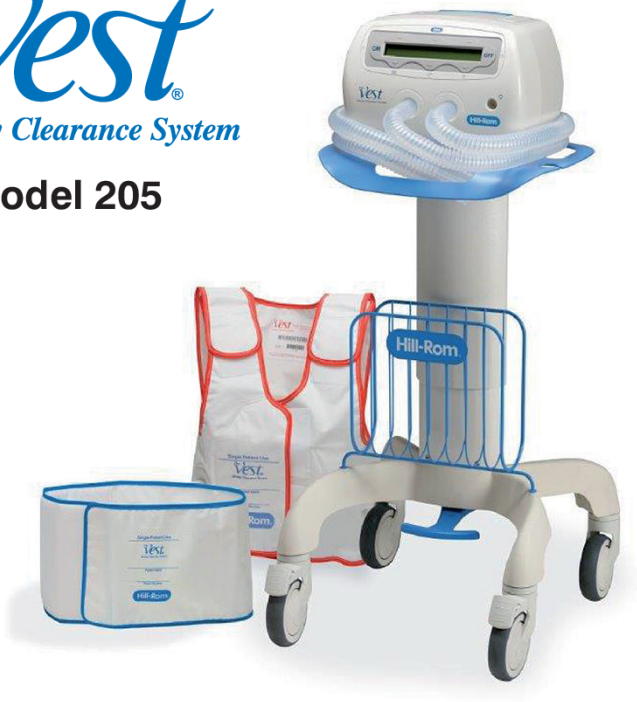
MATIO sp. z o.o.

to sprawdzony od 7 lat dystrybutor
urządzeń do drenażu dróg oddechowych
amerykańskiej firmy Hillrom

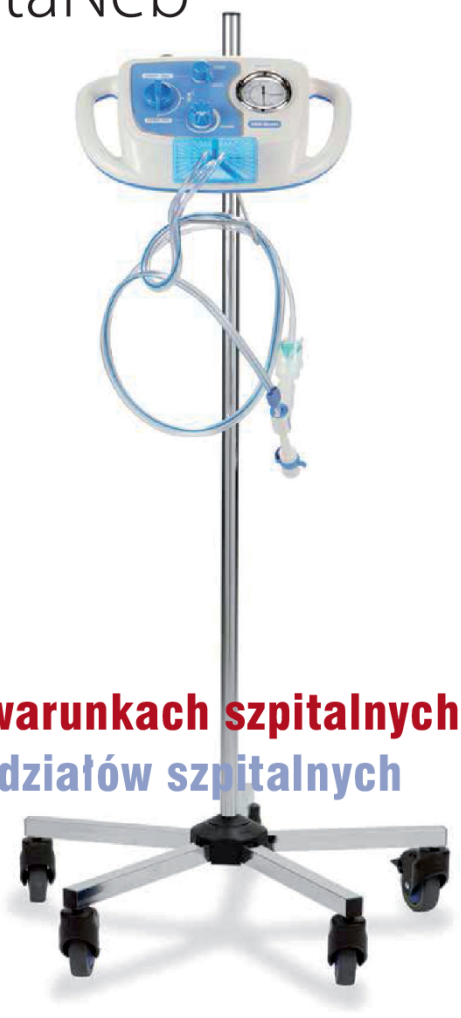
Hill-Rom

The Vest® Airway Clearance System

model 205



MetaNeb™



do drenażu i nebulizacji dla pacjentów w warunkach szpitalnych
– ze sprzętu w Polsce korzysta wiele oddziałów szpitalnych

MATIO sp. z o.o., ul. Celna 6, 30-507 Kraków, tel./fax (+4812) 296 41 47,
tel. kom. 511 832 040, e-mail:matio_med@mukowiscydoza.pl, www.matio-med.pl

fizjoterapia polska
nr 4/2022 (22)

Adjunctive effect of pulsed electromagnetic field therapy on quadriceps muscle strength after burn injury

Wspomagający wpływ terapii pulsacyjnym polem elektromagnetycznym na siłę mięśnia czworogłowego po oparzeniu

Walaa Abd El Aziem Abd El Aziz[1(A,B,C,D,E,F,G)], Wafaa Hussein Borhan[1(A,B,D,E)], Haidy Nady Ashem[1(A,B,C,D,E,F)], Ashraf El Sebaie Mohammed[2(A,B,D,E)]

[1]Surgery and Burns Department, Faculty of Physical Therapy, Cairo University, Cairo, Egypt
[2]Plastic Surgery Department, Faculty of Medicine, Cairo University, Cairo, Egypt

Abstract

Purpose. This study was conducted to examine the effect of pulsed electromagnetic field therapy on quadriceps muscle strength after burn injury.

Methods. From April 2021 to June 2022, sixty male patients who suffered from second degree lower limb thermal burn injury and Total body surface area (TBSA) from 25% to 35% participated in this study. Their ages ranged from (20-40) years. They were randomly assigned in two groups, a study group composed of 30 patients who received (PEMF) over thigh area before strengthening exercise for quadriceps muscle and a control group composed of 30 patients who received strengthening exercise for quadriceps muscle. Patients of both groups received traditional physical therapy program.. Evaluation tool was isokinetic dynamometer to measure the quadriceps muscle peak torque before the treatment and after 8 weeks of treatment for both groups.

Results. There was no significant difference between both group (study and control) in mean values of quadriceps peak torque pre-treatment ($P > 0.05$). There was a significant increase in the mean values of quadriceps peak torque after 8 weeks of treatment in both groups ($p < 0.05$) while there was a significant difference in post treatment mean values of quadriceps peak torque in the study group when compared with control group ($p < 0.05$).

Conclusion. Pulsed electromagnetic field therapy is an effective modality that can be used for improving muscle strength and performance in patients with lower limb burn when applied prior to strengthening exercise.

Keywords

pulsed electromagnetic field therapy, strengthening exercise, quadriceps peak torque, lower limb burn

Streszczenie

Cel. Badanie to przeprowadzono w celu zbadania wpływu terapii pulsacyjnym polem elektromagnetycznym na siłę mięśnia czworogłowego po oparzeniu.

Metody. Od kwietnia 2021 do czerwca 2022 w badaniu wzięło udział 60 mężczyzn, którzy doznali oparzenia kończyny dolnej II stopnia i całkowitej powierzchni ciała (TBSA) od 25% do 35%. Ich wiek wahał się od 20-40 lat. Pacjenci zostali losowo przydzieleni do dwóch grup, grupy badanej składającej się z 30 pacjentów, którzy byli poddawani działaniu PEMF nad obszarem uda przed wykonywaniem ćwiczeń wzmacniających mięsień czworogłowy i grupy kontrolnej złożonej z 30 pacjentów, którzy wykonywali ćwiczenia wzmacniające mięsień czworogłowy. Pacjenci obu grup realizowali tradycyjny program fizykoterapii. Narzędziem oceny był dynamometr izokinetyczny do pomiaru szczytowego momentu siły mięśnia czworogłowego przed leczeniem i po 8 tygodniach leczenia dla obu grup.

Wyniki. Nie zaobserwowano istotnej różnicy między obiema grupami (badana i kontrolna) w średnich wartościach szczytowego momentu siły mięśnia czworogłowego przed leczeniem ($p > 0,05$). Wystąpił istotny wzrost średnich wartości szczytowego momentu siły mięśnia czworogłowego po 8 tygodniach leczenia w obu grupach ($p < 0,05$). Wystąpiła istotna różnica w średnich wartościach szczytowego momentu siły mięśnia czworogłowego po leczeniu w grupie badanej w porównaniu z grupą kontrolną ($p < 0,05$).

Wniosek. Terapia pulsacyjnym polem elektromagnetycznym jest skuteczną metodą, która może być stosowana do poprawy siły mięśni i wydajności u pacjentów z oparzeniami kończyn dolnych, gdy jest stosowana przed ćwiczeniami wzmacniającymi.

Słowa kluczowe

pulsacyjna terapia polem elektromagnetycznym, ćwiczenia wzmacniające, szczytowy moment siły mięśnia czworogłowego, oparzenie kończyn dolnych

doi.org/10.56984/8ZG1A6ZsV

Introduction

Burn injuries cause the highest metabolic rate when compared to other critical injuries. Severe burns that cover more than 30% of the body's surface area cause skeletal muscle catabolism, which is exacerbated by extended periods of physical inactivity, which in turn cause muscle weakness. Additionally, current research has shown that burn directly affects the skeletal muscles' gene expression and mitochondrial activity, which in turn affects how well they work. So, improvement of muscle strength is a key research subject in burn therapy because this weakness remains despite "normal" recovery treatments [1].

Serious burn injury results in an extreme loss of muscle mass, strength, and function, which negatively impacts functional capacity, diminishes endurance, and makes it difficult to stand or walk which hindering post-burn rehabilitation [2].

In clinical groups prone to muscle wasting, resistance training-in which muscles contract against an opposing load-has been demonstrated to be a helpful tool in rehabilitation. By primarily increasing the amount of contractile proteins, which accelerates protein synthesis on cellular level, resulting in muscle hypertrophy, which enhances muscle size, force production, physical function, and quality of life [3].

In physiotherapy, pulsed electromagnetic field (PEMF) is a non-thermal, noninvasive, secure, and reasonably priced technique [4]. The magnetic field activity assumed that the cellular membrane was its primary target. The altered ion binding and transport is the proposed mechanism by which the magnetic fields modify the signal transduction pathways [5]. Vasodilatation, an increase in tissue oxygenation, improved membrane potential function, and improved ion exchange are only a few of the physiologic consequences of PEMF. These biological impacts could improve blood circulation, muscle strength, and bone unification while reducing pain and inflammation. PEMF may also mimic the effects of mechanical stimuli, which may be helpful for those who find it difficult to exercise without discomfort [6].

Recent studies have demonstrated that PEMF can enhance skeletal muscles contraction. Skeletal muscle subjected to PEMF displayed improved performance by preserving contractile force output and delaying the onset of fatigue when challenged with resistance exercise [7]. Skeletal muscles exposed to PEMF also have less cell damage after exercise indicating that PEMF provided protection from exercise-induced damage [8]. Therefore, this study aimed to investigate the effect of pulsed electromagnetic field therapy on quadriceps muscle strength after burn injury

Subjects and Methods

Study Design

The current study was designed as a prospective randomized controlled trial. Data were collected pre and post treatment from April 2021 to June 2022. The ethical approval was first taken from the committee responsible for the scientific research ethics in the faculty of physical therapy belonging to Cairo University.

Participants

This study was conducted in collaboration with the Outpatient Clinic of Faculty of Physical Therapy and from the Burn Unit at Orabi Hospital for Burns, Al Obour City.

The study protocol was approved by the ethical committee of each participating institute.

Eligibility criteria

Patients were males. Their ages ranged from (20–40) years. Patients suffered from second-degree lower limb burn of thermal injury. Total body surface area (TBSA) for the burns will be ranged from 25% to 35%. Patients began the training program after complete burn wound healing. Patients enrolled to the study had their informed consent. All patients received the same medical and traditional physical therapy program during the acute stage in the form of range of motion exercise, stretching, splinting, massage, functional training for ambulation and activities of daily living. All patients were asked to maintain their regular diet normal daily activities and lifestyle during the study. All patients are being ambulatory without the use of an assistive device.

The exclusion criteria

Patients who participated in any rehabilitation program to improve muscle strength prior to the study. Musculoskeletal disorders that impair performance during training and tests. Patients who have equilibrium disorders, uncontrolled cardiovascular or pulmonary diseases, neurological and renal disorders, metabolic or vascular disease with a neurological component such as diabetes,, leg amputation, malignant conditions, psychiatric illness, any previous disease could affect balance, vestibular and visual systems, severe behavior or cognitive disorders, lower limb lymphedema or lipoedema, lower limb deformity. Subjects with burn to the posterior thigh with knee flexion contracture, which affected the function of the quadriceps muscle. Athletic subjects. Subjects with morbid obesity. Any medication could affect the strength adaptations and adversely affect the results of the study.

Randomization

Index cards were numbered sequentially and placed in opaque envelopes. A blinded researcher opened the sealed envelope and allocated the patients according to their groups.

Interventions

In this study, the patients were assigned into two equal groups: Study Group (Pulsed Electromagnetic Field therapy, quadriceps strengthening exercises and traditional physical therapy program) and control Group (Quadriceps strengthening exercises and traditional physical therapy program).

Treatment administration

Patients were informed about treatment procedure, also about the effect of pulsed electromagnetic field therapy on improving quadriceps muscle performance when applied prior to strengthening exercises before beginning the treatment. Patients were asked to follow physician instructions. Patients were asked to avoid participation in any rehabilitation program prior to the study except regular rehabilitation in the form range of motion exercise, splinting, stretching, functional training for activities

doi.org/10.56984/8ZG1A6ZsV

of daily living and ambulation that done during hospitalization stage. Treatment procedures were applied for each patient as the following:

Traditional physical therapy care
All patients in both groups received traditional physical therapy program in the form of range of motion exercise, stretching, splinting, massage, functional training for ambulation and activities of daily living.

Strengthening exercises for quadriceps
For all patients in both groups:

Three-repetition maximum test (3RM)
The greatest amount of weight a subject can move through the available range of motion for 3 times was used as the baseline measurement of a subject's maximum effort. Patients enrolled in the strengthening exercise training group were tested to determine the amount of weight or load that was used during the first (1-2) week (of the 8 weeks program) as baseline loads.
The three repetitions maximum (3RM) load was determined as follows: Following a period of instruction in proper weight lifting technique, the patient warmed up and was given to become familiar with the movement. The patient then lifted a weight that allowed successful completion of four repetitions. If the fourth repetition was completed correctly and using the right technique, a 1 min resting period was permitted. After the resting interval, a gradually increased amount of weight or load was instructed to be lifted at least four times. If the weight lifted permitted the patient to successfully complete three repetitions with the fourth repetition not being volitionally possible due to fatigue or inability to maintain proper technique, the test was ended and the amount of weight lifted from the successful set was recorded as their individual 3RM [9].

Strengthening exercise program
All exercise sessions were preceded by a 5-min warm-up period and followed by 5-min cooling down.).Free Weights (sandbags and dumbbells) for strengthening of quadriceps muscle. The active phase of exercise consist of:
1. Straight-leg raising from supine position, 3 sets
2. Seated knee extension from 90° to full extension, 3 sets
3. Quadriceps Short Arc exercise (terminal knee extension), 3 sets.
4. Quadriceps Step-up and down, 3 sets.
5. Mini squats from 0 to 45° of knee flexion holding weights in hands, 3 sets.
6. Progress squats to greater ranges of knee flexion during the advanced phases of treatment.
7. Increase the difficulty of the exercise by performing unilateral resisted mini squats (single leg squat).

Parameters of the exercise program
Intensity: The weight or load the patients lifted was set at 50–60% of their individual 3RM, during the first (1-2) weeks. After that, the lifting load is increased to 70–75% (3 sets of 10 repetitions) of their individual 3RM and continued for weeks (3–6). After this, training intensity is increased to 75–85% of the 3 RM and implemented from weeks 7–8.
Frequency: 3 sessions per week for 8 weeks.
Number of repetitions: 3 sets, 12-15 repetitions in each set during first (1-2) weeks, 8-10 repetitions in each set during (3-6) weeks and 8-10 repetitions in each set during (7-8) weeks.
Rest period: rest interval of approximately 1 min between sets.
Total treatment duration: 8 weeks [9] [10].

Pulsed electromagnetic field therapy
For patients in the study group only. This group of patients was composed of thirty patients who received pulsed magnetic field over thigh areas for 24 sessions over a period of 8 weeks (3 sessions/week).
The patient received pulsed magnetic field immediately before each strengthening exercises training session. Then, patients received strengthening exercises for quadriceps muscle. Patients also received traditional physical therapy program in the form of range of motion exercise, stretching, splinting, massage, functional training for ambulation and activities of daily living. Patients did not receive any other training program to improve muscle strength and they were free from any other health problems that may affect the outcomes of the study. ELETTRONICA PAGANI Pulsed electromagnetic field therapy device (Mod: CMP 2 Plus, Power: 230 V – 50 HZ – 900 VA, Class: I Type B, Max out: 50 + 50 Gauss, Made in Italy 2014) was used in this study.
For Application: Removal of metals or things that can be affected by a magnetic field was assured prior to magnetic field application. Each participant was requested to assume a lying posture on the treatment bed. Before beginning the treatment, the device was checked. Switch the device on. The device was aligned directly over thigh area. The treatment parameters were set as 30 Hz frequency, 40 gauss amplitude, and 30 minutes as total treatment duration. After end of treatment switch the device off [11].

Outcome measures
The peak torque of the quadriceps muscle was measured before the treatment and after 8 weeks of treatment for both groups by using: Biodex Multi-joint System 3 isokinetic dynamometer (Biodex Medical System, Shirley, NY, USA) available at the isokinetic unit in Faculty of Physical Therapy, Cairo University.

Procedure for Evaluation
Patients warmed up for 5 min on a cycle ergometer then quadriceps, hamstrings and calf muscles was stretched 3 times with a 30 seconds stretch and a 30 seconds rest.
Following the warm-up, Patients were positioned in an isokinetic dynamometer in accordance with the equipment instructions; The measurements were carried out with the backrest reclined 5° from vertical and knees flexed 90 degrees and straps fixing the trunk, waist and distal thigh. The rotation axis of the dynamometer was aligned with the axis of the knee joint at the level of the lateral epicondyle of the femur while it was attached to the distal part of the leg about 5cm above the medial malleolus and isokinetic test was performed at angular velocity of 150 degree per second, because it is well tolerated by burn patients. Gravity effect correction and isokinetic device were calibrated before each evaluation and training session as recommended by

doi.org/10.56984/8ZG1A6ZsV

the manufacturer. The test procedures were demonstrated and explained to the patients.

For familiarization, Patients performed a series of three submaximal contractions without load as warm-up. After warming up, subjects were requested to perform ten maximal voluntary contractions consecutively without rest in between the knee joint moved through the range of motion from 90 degree to full extension. There was three minutes of resting before repeating the test. Verbal encouragement as well as visual feedback from the equipment were given to all participants in an attempt to achieve maximal voluntary effort level during all the contractions. Values of the highest beak torque were calculated by the Biodex software system and mean value was taken for statistical analysis [12].

Statistical analysis

Unpaired t-test were conducted for comparison of subjects' characteristics between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Unpaired t-test was conducted to compare the mean values of quadriceps peak torque between the study and control groups. Paired t-test was conducted for comparison between pre and post treatment in each group. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Results

Subject characteristics

Table 1. showed the subject characteristics of the study and control groups. There was no significant difference between groups in age, BMI and TBSA ($p > 0.05$).

Table 1. Basic characteristics of participants

	Study group Mean ± SD	Control group Mean ± SD	MD	t- value	p-value
Age [years]	29.00 ± 5.66	28.56 ± 4.88	0.44	0.31	0.75
BMI [kg/m²]	26.77 ± 1.89	26.50 ± 1.88	0.27	0.56	0.57
TBSA [%]	29.90 ± 3.15	30.20 ± 3.08	−0.3	−0.37	0.71

SD: standard deviation; p-value: level of significance

Effect of treatment on quadriceps peak torque

Within group comparison

There was a significant increase in quadriceps peak torque post treatment in study and control groups compared with that pre treatment ($p > 0.001$). The percent of increase in quadriceps peak torque in study group was 52.47% and that in control group was 33.16%. (Table 2).

Between groups comparison

There was no significant difference between groups pre-treatment ($p > 0.05$). Comparison between groups post treatment revealed a significant increase in quadriceps peak torque of study group compared with that of control group ($p < 0.001$). (Table 2).

Table 2. Mean quadriceps peak torque pre and post treatment of study and control groups

		Study group Mean ± SD	Control group Mean ± SD	MD	t- value	p value
Quadriceps peak torque [Nm]	Pre treatment	92.37 ± 4.85	92.29 ± 4.83	0.08	0.06	0.95
	Post treatment	140.84 ± 7.09	122.89 ± 7.12	17.95	9.78	0.001
	MD	−48.47	−30.6			
	% of change	52.47	33.16			
	t- value	−89.71	−52.28			
		p = 0.001	**p = 0.001**			

SD: standard deviation; MD: mean difference; p-value: probability value

Discussion

The current study's findings demonstrated that post-treatment mean values of quadriceps muscle peak torque were significantly increased in both groups, but when comparing the two groups, there was a significant difference in mean values of quadriceps muscle peak torque after 8 weeks of treatment in the study group compared to that in the control group, which explained that this effect not only resulting from strengthening exercises but also from the effect of the application of pulsed electromagnetic field therapy.

The positive change in muscle torque may be due to that pulsed magnetic field's potentially has stimulatory effects on the neuromuscular system, which in turn may help to recruit more motor units during muscle contraction. Furthermore, its microcirculato-

doi.org/10.56984/8ZG1A6ZsV

ry effects may be connected to variations in strength. Additionally, pulsed magnetic fields have the capacity to directly stimulate motor nerves, resulting in the generation of action potentials that stimulate muscles. If this process is repeated and continued for an extended period of time, it may enhance the capacity of muscles to produce force as well as possibly increase muscle cross-section [13].

Pulsed electromagnetic field could also improve mitochondrial respiration, synthesis of ATP and resistance to oxidative stress [14]. Moreover, PEMFs can alter activity of metabolic enzymes with alteration of multiple signaling pathways [15], up regulate gene expression [16] and improve protein synthesis [17]. So, PEMFs exposure could increase muscle strength and muscle mass. PEMFs can also minimize the effect of fatigue and time spent in recovery [18] and provide protection against exercise induced damage [8].

A number of studies have shown that pulsed electromagnetic field application resulted in improved muscle strength. According to the findings of the study by Madariaga et al. [19], which examined the effects of direct magnetic stimulation on the quadriceps muscle, study participants were able to contract the quadriceps muscle in isometric mode to the tune of 80% of the maximum twitch stimulation, which is regarded as adequate for direct magnetic stimulation and can be used in muscle rehabilitation.

Our findings are similar the results of the study by Heneidy et al. [20] who evaluated the knee muscle strength using isokinetic dynamometer for each patient of study group (received physical therapy program plus pulsed electromagnetic field) and control group (received physical therapy program only) who suffered from knee hemarthrosis. Significant improvement was observed in study groups and control group ($p < 0.05$). High significant improvement was observed in the study group when comparing the post-treatment results of both groups ($p < 0.05$).

In a study by Parhampour et al. [11] with similar aim to ours. It was found that in severe haemophilic A patients, muscle strength and balance tests significantly improved in the resistance training (RT) and resistance training plus PEMF (RTPEMF) groups compared to the control group. Additionally, there was a significant difference between the mean post-treatment values of the (RTPEMF) group, the (RT) group, and the baseline values (P 0.05). As a result, RT and RTPEMF are beneficial in helping individuals with severe haemophilia A maintain their balance and muscular power.

Our findings are also in agreement with a study by Bustamante et al. [21] In COPD patients, As all patients finished the training showing a significant improvement in voluntary quadriceps strength (17.5 percent of the baseline value) and exercise capacity, with a mean increase of 23 m in the six-minute walking test, they came to the conclusion that magnetic neuromuscular stimulation of the quadriceps constitutes a feasible training method for the lower limbs.

Positive change in muscle torque due to that pulsed magnetic field's was proved in a study by Gorodnichev et al. [7]. The gastrocnemius of the subjects in the electromagnetic stimulation group was exposed to training exercises (the foot plantar flexion) (1.8 T, 5 Hz). The only workouts being performed by the subjects in the control group. After 10 days of training, there was a considerable (24%) rise in the experimental group's power torque for plantar flexion. In the control subjects, there was no discernible difference in the power torque of the foot's plantar flexion. They postulated that the experimental group's subjects' increased muscular strength was caused by electromagnetic stimulation's activation of high-threshold motor units.

The results of current study is also confirmed by Abdullah [13] who found that pulsed magnetic field has beneficial effects on quadriceps muscle peak torque, hamstring muscle peak torque and knee proprioception accuracy in healthy athletic subjects and can be advised as an adjunctive tool in rehabilitation programs.

Pulsed magnetic stimulation was suggested by Jawad et al. [18] as an adjunct for resistance training for quadriceps muscle during resistance training protocol.

In the light of positive findings of the present study and the general absence of undesired effects, PEMF may represent challenging area for future research.

Study limitations

This study was limited by the difficulty of performing follow up of the patients after ending the treatment protocol, individual differences in patients and their response to the treatment, possible human errors and patient cooperation.

Conclusion

Based on the obtained data application of both PEMF and strengthening exercise can be used as an effective strategy in the burn rehabilitation program for improving muscle strength and performance in patients with lower limb burn.

Adres do korespondencji / Corresponding author

Walaa Abd El Aziem Abd El Aziz

E-mail: walaaamr106@gmail.com

Acknowledgments

The authors would like to thank all participants in the current study.

Piśmiennictwo/ References

1. Al Qahtani M., Abd El Baky A., Waked I. and Mohammad W. Effect of Isokinetic Training on Burned Patient Muscle Strength: A Systematic Review. World Wide Journal of Multidisciplinary Research and Development. 2018; 4(4): 53-58.

2. Hart D.W., Wolf S.E., Mlcak R., Chinkes D.L., et al. Persistence of muscle catabolism after severe burn. Surgery. 2000; 128(2):312–319.
3. Gittings P.M., Grisbrook T.L., Edgar D.W., Wood F.M., et al. Resistance training for rehabilitation after burn injury: A systematic literature review meta-analysis. Burns. Elsevier. 2018; 44:731-751.
4. Luigi C. and Tiziano P. Mechanisms of Action and Effects of Pulsed Electromagnetic Fields (PEMF) in Medicine. Med Res Surg. 2020; 1(6): 1-4.
5. Markov M. Pulsed electromagnetic field therapy history, state of the art and future. Environmentalist. 2007; 27 (4): 465-475.
6. Khami A., Roostayi M., Parhampour B., Heidari Z., et al. Effect of Pulsed Electromagnetic Fields on Clinical Signs and Quality of Life in Patients with Hemophilic Arthropathy of the Knee Joint: A Randomized Controlled Trial. Adv Biomed Res. 2020; 9: 81.
7. Gorodnichev R. M., Beljaev A. G., Pivovarova E. A., and Shlyakhtov V. N. The Effect of Electromagnetic Stimulation on the Parameters of Muscular Strength. Human Physiology. 2014; 40(1): 65–69.
8. Kang s., Park J., Jeon H. and Lee H. The Influences of Pulsed Electromagnetic Field Treatment Following Experimentally Induced Delayed-Onset Muscle Soreness in Biceps Brachii. Physical Therapy Korea. 2013; 20(2):11-19.
9. Serghiou M., Ott S., Farmer S., Morgan D., et al. Comprehensive rehabilitation of the burn patient. In Total Burn Care, Herendon D. editor, Philadelphia, Elsevier Inc. 2007: 620-651.
10. Grisbrook T., Reid S., Edgar D., Wallman K., et al., Exercise training to improve health related quality of life in long term survivors of major burn injury: A matched controlled study. Burns. 2012; 38:1165–73.
11. Parhampour B., Torkaman G., Horfar H., Hedayati M., et al. The Effect of Resistance Training With and Without Pulsed Electromagnetic Field on Muscle Strength and Balance in Severe Haemophilia A Patients. Research in Rehabilitation Science. 2013; 9(2): 171 -184.
12. Ebid A., El-Shamy S. and Draz A. Effect of isokinetic training on muscle strength, size and gait after healed pediatric burn. Burns. 2014; (40):97:105.
13. Abdullah M. Effect of pulsed magnetic field on peak torque of quadriceps /hamstring muscles and knee proprioception in atheletic subjects: A randomized controlled study. Int J Physiotherapy. 2017; 4(6): 371-376.
14. Yap J., Tai Y., Fröhlich J., Fong C., et al. Ambient and supplemental magnetic fields promote myogenesis via a TRPC1-mitochondrial axis: evidence of a magnetic mitohormetic mechanism. FASEB journal: official publication of the Federation of American Societies for Experimental Biology. 2019; 33(11), 12853–12872.
15. Yang J., Sun L., Fan X., Yin B., et al. Pulsed electromagnetic fields alleviate streptozotocin induced diabetic muscle atrophy. Mol Med Rep.2018; 18(1):1127-1133.
16. Antonio M., Gabriella D., Chiara C., Emanuela O., et al. Neuromuscular magnetic stimulation counteracts muscle decline in ASL patients. Scientific Reports 2019; 9:2837.
17. Blank M. Protein and DNA reactions stimulated by electromagnetic fields. Electromagnetic Biology and Medicine. 2008; 27(1):3-23.
18. Jawad F., Yvonne L., Emma R., William H., et al. Peripheral Electrical and Magnetic Stimulation to Augment Resistance Training. J. Funct. Morphol. Kinesiol. 2016; (1): 328–342.
19. Madariaga V., Manterola A., Miró E. and Iturri J. Magnetic Stimulation of the Quadriceps: Analysis of 2 Stimulators Used for Diagnostic and therapeutic Applications. Arch Bronconeumol. 2007; 43(7):411-417.
20. Heneidy W., Behiry M. and Kassem H. Efficacy of pulsed electromagnetic field on hemarthrotic knee in haemophilic adolescence. Human Sport & Exercise. 2021; 16 (4):1639-1648.
21. Bustamante V., López de Santa María E., Gorostiza A., Jiménez U., et al. Muscle training with repetitive magnetic stimulation of the quadriceps in severe COPD patients. Respir Med. 2010; 104(2):237-45.

doi.org/10.56984/8ZG1A6ZsV