Vol. 10 No. F (2022): F - Review Articles

Published: 2022-01-01

Narrative Review Article

School-based Interventions to Improve Adolescent Resilience: A Scoping Review

Fandro Armando Tasijawa, Indah Siagian (Author)

33-40

PDF

Vascular Anatomy and Variants: Knowledge during Laparoscopic Right Colectomy

Danilo Coco, Silvana Leanza (Author)

531-534

PDF

The Biological Role of Advanced Glycation End Products in the Development and Progression of Colorectal Cancer

Muthear Dawood, Zaid Muwafaq Younus, Mohammed Alnori, Sameer Mahmood (Author)

487-494

PDF

Cellulose Sponge, the Detector of Esophageal Cancer: Innovation for Early Detection of Esophageal Cancer without Biopsy?: A Mini Review

Nurul hidayah, Yuna Annisa Salsabila (Author)

386-390

PDF

Gastrointestinal Endoscopy and Coronavirus Disease-2019 Pandemic

Darmadi Darmadi, Cennikon Pakpahan, Riska Habriel Ruslie (Author)

81-85

PDF

Platelet-Rich Plasma: Applications in Cosmetic Dermatology

Boy Ardi Rohanda, Nelva Karmila Jusuf (Author)

609-613

PDF

The Proof of Quantum and Fuzzy Measures as Generalization of Measure That Does Not Generalize Each Other

Miftahul Fikri, Zuherman Rustam, Kurniawan Atmadja, Nurhadi Hadi (Author)

548-555

PDF

Telephone-based Support in Preventing Stoma and Peristomal Complications: A Review of Literature

Rose A. Nain, Fatimah Ahmedy, Deena Clare Thomas (Author)
726-730

PDF

Women's Empowerment to Improve Nutritional Status in Children: A Systematic Review

Apriyani Puji Hastuti, Tintin Sukartini, Yuni Sufyanti Arief, Nursalam Nursalam, Hanim Mufarokhah (Author)
41-47

PDF

The Importance of T-Scan III Digital Electronic System in Fixed Restorations Occlusal Analysis – A Review

Rajmonda Halili, Jadranka Bundevska, Alban Shabani, Sotir Maja, Sebahate Hamiti Alidema (Author)
444-447

PDF

Arrhythmia-induced Cardiomyopathy: An Article Review

Sidhi Laksono Purwowiyoto, Hillary Kusharsamita (Author)
49-56

PDF

Obstetric Outcomes and Successful Reduction of Twin Pregnancies Achieved by In Vitro Fertilization

Gergana Ingilizova, Emil Kovachev, Galina Yaneva (Author)
283-288

PDF

How Can Mobile Health Technology Improve Usage and Delivery of the COVID-19 Vaccine in Low- and Middle-Income Countries?

Eman Hany Elsebaie , Mohamed Abdelhamed Fathy, Amira Karam Khalifa , Mustafa Omar Sharaf El-Deen, Mennatallah Ahmed Alnagdy, Samaa Talaat Elsaidy, Amal Mostafa Fouda, Kerolos Hany Abdelaziz Morques, Notaila Mohammed Shehata, Marwa Rashad Salem (Author)
437-443

PDF

A Current Concepts Update in Pilon Fracture Management

Pamudji Utomo, Mujaddid Idulhaq, Muhammad Abdulhamid (Author)
475-486

PDF

A Review on Phytochemicals and Pharmacological Activities as Ethnomedicinal Uses of Duku (Lansium domesticum Corr.)

Muhammad Fauzan Lubis, Poppy Anjelisa Hasibuan, Hafid Syahputra, Ririn Astyka (Author)

57-65

PDF

The Current State and Prospects for the Use of Herbal Medicines for Wound-Healing and Anti-Inflammatory Action in Kazakhstan: A Literature Review

Aigul Medeshova, Perizat Orazbayeva, Ainur Romanova, Nuripa Dildabekova, Bekzhan Orazbayev, Bibigul Ashirbekova, Anar Bokenovna (Author)

641-647

PDF

Behind the Double Helix: The Complicated Life of Rosalind Franklin

Roberto Arrigoni, Rosa Porro, Mario Dioguardi, Filiberto Mastrangelo, Angela Pia Cazzolla, Francesca Castellaneta, Ioannis Alexandros Charitos, Stefania Cantore, Michele Covelli (Author)

758-762

PDF

The Effectiveness of Emotional Freedom Technique on Public Speaking Anxiety in University Student: An Integrated Review

Nenden Lesmana Wati, Tukimin Bin Sansuwito, Dwiagung Riyanto, Agus Sustiyono, Fifi Musfirowati (Author)

263-268

PDF

Celiac Disease: Disease Models in Understanding Pathogenesis and Search for Therapy

Anton Chaykin, Elena Odintsova,`Andrey Nedorubov (Author)

705-719

PDF

Mini-review: Modern Concept of Pelvic Organ Prolapse

Botagoz Aitbayeva, Serik Iskakov, Lazat Smailova (Author)

201-207

PDF

Acute Variceal Bleeding Is It Only the Success of Hemostasis That Guarantees the Positive Outcome?

Nikolay Tsonev, D. Vundeva, K. Toncheva, Dimitar Zvezdov, I. Petrov, D. Dimitrova, D. Petrova (Author)

90-95

PDF

Role of Curcumin as a Potential Immunomodulator to Adjunct Tuberculosis Treatment in Indonesia

Emir Gibraltar Faisal, Shakira Amirah, Sidik Maulana, Maria Komariah, Hesti Platini (Author)

326-331

PDF

Vitamin D Target Genes in Dental Health

Ashwini Tumkur Shivakumar, Sowmya Halasabalu Kalgeri, Prasanna K. Santhekadur (Author)

571-577

PDF

Enteral Glutamine Supplementation is Associated with Lowering Wound Infection Morbidity and Length of Hospital Stay among Burn Patients: A Meta-analysis and Systematic Review

Ni Made Ratih Purnama Dewi, Agustinus I Wayan Harimawan, I Gusti Putu Hendra Sanjaya, Gede Wara Samsarga (Author)

246-250

PDF

Enhancing the Community Health through Restricting Electronic Cigarettes

Muhammad Syahriza, M. S. Hendra Wahyuni, Z. Khairunnisa (Author)

522-524

PDF

Biological Therapy for Osteoarthritis, Efficacy and Safety: Focus on Monoclonal Antibodies against Nerve Growth Factor and Fibroblast Growth Factor-18

Lina Zaripova, Mishi Pallav, Damira Tazhibaeva, Natalya Kabdualieva, Zhaina Aitbayeva , Gulshakhar Beglarova , Lazzat Yermentayeva, Karlygash Niyazbekova (Author)

697-704

PDF

The Efficacy of Topical Photodynamic Therapy in Precancerous Lesions of the Skin: A Literature Review

Imam Budi Putra, Nelva Karmila Jusuf, Calvina Theresia (Author)

86-89

PDF

COVID-19 Risk Management in Dental Offices: A Review Article

Seyedeh Sara Aghili, Aida Pourzal, Seyed Ali Mosaddad, Samira Amookhteh (Author)

763-772

PDF

E-Health in the Prevention of Drug Abuse in Adolescents: A Literature Review

Ahmad Yani, Sukri Palutturi, Ridwan Amiruddin, Sudirman Nasir (Author)

153-157

PDF

Cardiovascular Disorders as a Result of COVID-19

Liudmila Kovalevskaiia, Alireza Pakhlevanzade , Svetlana Ivanchenko, Larysa Kupriianova, Veronika Volianska, Alexander Plakida, Pradosh Panigrahi (Author)

1862-1868

PDF

Distinct Secretion of MUC5AC and MUC5B in Upper and Lower Chronic Airway Diseases

Said Ahmad Shah, Hajime Ishinaga, Kazuhiko Takeuchi (Author)

215-223

PDF

Chairless Chairs for Orthopedic Surgery Purpose – A Literature Review

Gatot Santoso, S. Sugiharto, Abdul Mughni, Muhammad Imam Ammarullah, Athanasius P. Bayuseno, J. Jamari (Author)

146-152

PDF

Potential Use of Patient-Specific Induced Pluripotent Stem Cell for Liver Fibrosis Thalassemia Treatment Management

Susi Susanah, Wahyu Widowati, Nur Melani Sari, Revika Revika, Hanna Kusuma, Rizal Rizal, Ahmad Faried (Author)

122-128

PDF

Literature Review: Relating Factors to the Effectiveness of Occupational Health and Safety Program Performance

Andi Surayya Mappangile, Doni Hikmat Ramdhan (Author)

420-426

PDF

Medical Liability, Defensive Medicine, and Introduction to Professional Insurance in the Republic of Kazakhstan

Makpal Alchimbayeva, Tolebay Rakhypbekov, Gulmira Bazarova, Aigerm Baimagambetova, Oxana Tsigengagel (Author)
495-500

PDF

Microbiological Aspects Concerning the Etiology of Acute Odontogenic Inflammatory Diseases in the Soft Tissues of the Head and Neck Region

Mariia Faustova, Oleksandr Nazarchuk, Galina Loban', David Avetikov, Maiia Ananieva, Yuliia Chumak, Viktor Havryliev (Author)
636-640

PDF

COVID-19 Pandemic: What Considerations Should Be Taken during the Assessment and Management of COPD Exacerbation?

Saminan Saminan, Linda Julisafrida, Muhammad Ridwan, Nurul Fajri (Author)
71-80

PDF

Neurological Manifestations of Fabry Disease: Literature Review

Marina Grigolashvili, Ekaterina Kim, Shynar Muratbekova, Sholpan Omarova, Amirzhan Smagulov, Guldana Bektas, Rustam Tuleuov, Saltanat Madibraimova, Artyom Pakhomov, Olga Parkhanovich, Ekaterina Pogorelova, Gulsara Kiyakpaeva (Author)
620-626

PDF

COVID-19 and Thrombosis Complication in Children

Herlina Dimiati, Nina Widasari (Author)
648-654

PDF

Anticoagulant and Antiplatelet Therapy in Periprocedural Period of Elective Gastrointestinal Endoscopy

Nikolay Tsonev, D. Vandeva, K. Toncheva, D. Zvezdov (Author)
364-370

PDF

Effects of Physical Exercise on Mitochondrial Biogenesis of Skeletal Muscle Modulated by Histones Modifications in Type 2 Diabetes

Hellen Barbosa, Wael Ramadan, Júlia Matzenbacher dos Santos, Sandra Aparecida Benite-Ribeiro (Author)
590-599

PDF

Effect of Co-parenting on the Prevention of Postpartum Blues and Quality of Breast Milk: A Literature Review

Gusti Ayu Martha Winingsih, Ummu Salmah, Masni Masni, Rahayu Indriasari, I Nyoman Mangku Karmaya, Ridwan Amiruddin, Sudirman Nasir, Agus Bintara Birawida (Author)

229-233

PDF

Recognition of Pathogens and Their Inflammatory Signaling Events

Ruqaih Alghsham, Zafar Rasheed, Ali Shariq, Abdullah S. Alkhamiss, Fahad A. Alhumaydhi, Abdullah S. M. Aljohani, Sami A. Althwab, Ahmad Alshomar, Homaidan T. Alhomaidan, Essam M. Hamad, Thamir Alsaeed, Rana Alghamdi, Waleed Al Abdulmonem (Author)

462-467

PDF

Neuroprotective Agents: A Simple Overview

Ageng Sunjoyo, Andy Nugroho (Author)

578-582

PDF

Medicinal Properties of Ant Nest Plant (Myrmecodia Genus): A Comprehensive Review

Septriyanto Dirgantara, Muhamad Insanu, Irda Fidrianny (Author)

97-103

PDF

Systematic Review Article

Gamma Knife Radiosurgery for Tremor Movement Disorder: A Systematic Review

Kevin Gunawan, Fabianto Santoso, Renindra Ananda Aman, David Tandian, Syaiful Ichwan, Setyo Widi Nugroho (Author)

731-735

PDF

Predictors that affect the Quality of Life Patient with Diabetes Mellitus: A Systematic Review

Masriadi Masriadi, Rizqy Iftitah Alam, Junaidin Junaidin, Eza Kemal Firdaus, Wa Ode Sri Asnaniar, Nur Ilah Padhila, Lidya Maryani, Al Ihksan Agus, Haeril Amir, Rahmat Hidayat, Fitriani Fitriani (Author)

340-344

PDF

COVID-19 Preventive Behavior Practices and Determinants: A Scoping Review

Lely Lusmilasari, Alenda Dwiadila Matra Putra, Ayyu Sandhi, Azam David Saifullah (Author)

23-32

PDF

Sanitation and Multiple Micronutrient Supplementation in Pregnancy Outcomes: Literature Review

Miranti Miranti, A. Arsunan Arsin, Ridwan Amiruddin, Veny Hadju, Atjo Wahyu, Sukri Palutturi, Muhammad Basir-Cyio, Muhammad Sabir, Diah Mutiarasari, Haerani Harun, Rahma Rahma, Rosa Dwi Wahyuni, Ketut Suarayasa (Author)

380-385

PDF

Patient Safety Education for Clinical Students: A Systematic Literature Review

Santi Anugrahsari, Uwes Anis Chaeruman, Hafid Abbas, Suryadi Suryadi (Author)

208-214

PDF

Risk Factors and the Assessment Tools for Subjective Memory Complaints in Asia

Izzati Mohd Bashir, Ponnusamy Subramaniam, Shabira 'Inani Md. Zaini, Shobha Sharma (Author)

675-682

PDF

Mouthwashes and the Effect on the Viral Load of SARS-CoV-2 in Saliva: A Literature Review

Mariano Ortiz Pizarro, Christian R. Mejia, David R. Rodríguez-Díaz, Ygnacio Moreno Herrera, Alexander Bustamante Cabrejo, Victor Serna-Alarcon (Author)

690-696

PDF

Virtual Simulation in Clinical Nursing Education to Improve Knowledge and Clinical Skills: Literature Review

Lina Ema Purwanti, Tintin Sukartini, Ninuk Dian Kurniawati, Nursalam Nursalam, Tri Susilowati (Author)

396-404

PDF

The Impact of Unwanted Pregnancy in Adolescents toward Pregnancy Care: A Systematic Review

Ermiati Ermiati, Restuning Widiasih, Henny Suzana Mediani (Author)

7-14

PDF

Pregnant Women's Perception of Pregnancy, Childbirth and Postpartum Care: Literature Review in Developing Countries

Dwi Rukma Santi, Dewi Suminar, Shrimarti Rukmini Devy, Mahmudah Mahmudah, Oedojo Soedirham, Anif Prasetyorini (Author)

600-606

PDF

Wolbachia in Dengue Control: A Systematic Review

Nor Rumaizah Mohd Nordin, Fadly Shah Arsad, Muhammad Hilmi Mahmud, Puteri Sofia Nadira Megat Kamaruddin, Siti Maisara Amir, Nor Izyani Bahari, Mohd Rohaizat Hassan, Syed Sharizman Syed Abdul Rahim, Khamisah Awang Lukman, Mohammad Saffree Jeffree (Author)

501-512

PDF

Pumpkin Seed Intervention to Control Diabetes Mellitus: A Systematic Review

Zhanaz Tasya, Ridwan Amiruddin, Aminuddin Syam, Yahya Thamrin (Author)

535-540

PDF

A Systematic Review on Hospital's Patient Satisfaction and Loyalty in Indonesia

Cita Rosita Sigit Prakoeswa, Nur Hidayah, Arlina Dewi (Author)

655-664

PDF

Impact of COVID-19 to Neurosurgical Education: A Systematic Review

Muhamad Thohar Arifin, Jacob Bunyamin, Yuriz Bakhtiar , Zainal Muttaqin (Author)

289-296

PDF

Forward-Looking Strategies for the Advancement of Obstetrics and Gynecology to Operate in a COVID-19 Pandemic World and Beyond: A Scoping Review

Sholpan Aliyeva, Vyacheslav Lokshin, Maksut Kamaliev, Sholpan Sarmuldayeva, Gulnur Tanbayeva, Viktor Shafranskyi, Oxana Tsigengagel, Aigerim Mukhamedyarova (Author)

683-689

PDF

Antenatal Depression as a Stunting Risk Factor: A Systematic Review

Rifzul Maulina, Mochammad Bagus Qomaruddin, Sri Sumarmi, Alfunafi Fahrul, Sri Haryuni (Author)

234-240

PDF

Public Health Interventions to Reduce Stunting in Toddlers: A Systematic Review

Dwi Rahmadiyah, Junaiti Sahar, Widyatuti Widyatuti (Author)

158-167

PDF

Patient Education Strategies among Patients with Acute Myocardial Infarction: A Systematic Review

Emil Huriani, Irza Wahid, Rizanda Machmud, Khatijah Lim Abdullah (Author)

405-412

PDF

Non-pharmacology Interventions on Pain in Critically Ill Patient: A Scoping Review

Vanny Leutualy, Devita Madiuw, Fandro Armando Tasijawa, Dene Fries Sumah, Feby Manuhutu, Sinthia Maelissa (Author)

182-189

PDF

Effective Clinical Supervision in Nursing: Systematic Review

Elis Anggeria, Derma Wani Damanik (Author)

525-530

PDF

Effect of Hydrogel Use on Healing Diabetic Foot Ulcers: Systematic Review

Armayani Armayani, Anisa Purnamasari, La Ode Reskiadin, Lisnawati Lisnawati, Nazaruddin Nazaruddin, Indra Indra, Wa Ode Aisa Zoahira, Fauziah H. Wada, Amzal Mortin Andas (Author)

448-453

PDF

Digital Nursing Technology to Achieve Job Satisfaction: A Systematic Review

Setyowati Setyowati, Diah Arruum, Hanny Handiyani, Raldi Artono Koestoer (Author)

104-112

PDF

A Systematic Review of Tropical Disease Prevalence among Migrants

Mohd Afiq Arifin, Chua Su Peng, Ummi Mirza Baharudin, Mohd Hafiz Baharudin, Muhammad Aklil Abd Rahim, Syed Sharizman Syed Abdul Rahim, Azman Atil, Mohd Faizal Madrim, Zulkhairul Naim Bin Sidek Ahmad, Khalid Mokti, Abdul Rahman Ramdzan, Mohammad Saffree Jeffree, Mohd Rohaizat Hassan (Author)

627-635

PDF

PDF

Food Security and Stunting Incidences in the Coastal Areas of Indonesia

Emy Yuliantini, Ketut Sukiyono, M. Zulkarnain Yuliarso, Bambang Sulistyo (Author)

454-461

PDF

The Effectiveness of Peer Group Support to Increase Health Related Quality of Life among Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome Patients: A Systematic Review

Misutarno Misutarno, Nursalam Nursalam, Tintin Sukartini, Khamida Khamida, Siti Nur Hasina (Author)

129-135

PDF

Systematic Review of Cardiovascular Manifestations in COVID-19 and Management Consideration

Fernanda Savitri Mega Pratistha, Rani Paramitha Iswari Maliawan, Hendy Wirawan, I.G.N. Putra Gunadhi (Author)

332-339

PDF

The Effect of Pumpkin Seed Biscuits and Moringa Capsules on (Malondialdehyde) Levels and Birth Outcomes of Pregnant Women

Ridha Ridha, Andi Zulkifli, Veni Hadju, Aminuddin Syam (Author)

278-282

PDF

The Potential of S100 Calcium-Binding Protein B and Glial Fibrillary Acid Protein in Predicting the Intracranial Lesions in Mild Traumatic Brain Injury: A Systematic Review of Literature

Andre Marolop Pangihutan Siahaan, Eric Teo Fernando (Author)

541-547

PDF

Psychological Well-being Structure of Indonesian Soldiers: Systematic Review

Sulistiyani Sulistiyani, Megah Andriany, Nur Setiawati Dewi (Author)

736-744

PDF

The Effect of Aromatherapy Administration in the Decrease of Nausea in Post-Spinal Anesthesia Patients

Meta-analytic Review Article

PDF

Coronary Heart Disease and Coronavirus Disease 2019: Pathogenesis, Epidemiology, Association with Myocardial Revascularization

Gulnara Batenova, Evgeny Dedov, Maksim Pivin, Igor Nikitin, Olga Ettinger, Yerbol Smail, Diana Ygiyeva , Lyudmila Pivina (Author)

319-325

PDF

The Impact of Extent of Resection on the Prognosis of Glioblastoma Multiforme: A Systematic Review and Meta-analysis

Dipak Chaulagain, Volodymyr Smolanka, Andriy Smolanka, Sunil Munakomi (Author)

345-354

PDF

Erythrocyte Antibody Due to Alloimmunization in Repeated Transfusion: A Meta-Analysis

Zelly Dia Rofinda, Eryati Darwin, Ellyza Nasrul, Irza Wahid (Author)

257-262

PDF

A Systematic Review and Meta-analysis of Randomized Placebo-controlled Trials 1 Year after Starting Sodium-glucose Transporter-2 Inhibitors in Heart Failure Patients with Reduced Ventricular Ejection Fraction

Arga Setyo Adji, Atiyatum Billah, Aufa Baraja, Assya Amrilia Permata Putri, Firman Suryadi Rahman (Author)

1-6

PDF

Meta-Analysis of Laparoscopic Pyelolithotomy versus Percutaneous Nephrolithotomy as a Treatment of Large Kidney Stones

Gede Wirya Kusuma Duarsa, Pande Made Wisnu Tirtayasa, Ida Bagus Putra Pramana, I. Wayan Yudiana, Kadek Budi Santosa, Anak Agung Gde Oka (Author)

113-121

PDF

Correlation between Platelet Count and Grading of Esophageal Varices in Liver Cirrhosis Patients: A Meta-Analysis

Fahri Ahmad Baihaqi, Dinda Olinda Delarosa (Author)

513-521

PDF

Overall Survival and Progression-Free Survival Comparison of Bevacizumab Plus Chemotherapy Combination Regiment versus Chemotherapy Only Regiment in Previously Untreated Metastatic Colorectal Cancer: Systematic Review and Meta-Analysis

Ikhwan Rinaldi, Kevin Winston, Leroy David Vincent, Abdillah Wicaksono, Muhammad Prasetio Wardoyo, Yusuf Aji Samudera Nurrobi, Jessica Leoni (Author)

269-277

PDF

Meta-synthesis Review Article

Low Molecular Weight Heparin Doses and Ventilator Airway Necessity in the COVID-19 Patients: Systematic Review and Meta-analysis

Yuyun Yueniwati, Mokhamad Fahmi Rizki Syaban, Athaya Febriantyo Purnomo, Edwin Kinesya, Yusuf Mannagalli, Erwin Alexander Pasaribu, Nurul Cholifah Lutfiana, Adilla Shafryantyo Purnomo (Author)

241-245

PDF

A review of Leaves and Seeds Moringa oleifera Extract: The potential Moringa oleifera as Antibacterial, Anti-Inflammatory, Antidiarrhoeal, And Antiulcer Approaches To Bacterial Gastroenteritis

Arga Setyo Adji, Nabila Atika, Yemima Billyana Kusbijantoro, Atiyatum Billah, Astrid Putri, Fitri Handajani (Author)

305-313

PDF

A Review of CRISPR Cas9 for Alzheimer's Disease: Treatment Strategies and Could target APOE e4, APP, and PSEN-1 Gene using CRISPR cas9 Prevent the Patient from Alzheimer's Disease?

Arga Setyo Adji, Jordan Steven Widjaja, Vira Aulia Kusuma Wardani, Alvian Habib Muhammad, Fitri Handajani, Hendy Bhaskara Perdana Putra, Firman Suryadi Rahman (Author)

745-757

PDF

The Evidence-based Effect of Platelet-rich Fibrin in Osteogenesis: A Systematic Review and Meta-analysis

Mujaddid Idulhaq, Ambar Mudigdo, Pamudji Utomo, Brian Wasita (Author)

66-70

PDF

Letter to the Editor

Comments about the “Systematic Review: Physical Rehabilitation Therapy for Long COVID-19 Patient with Respiratory Sequelae”

Emna Toulgui, Wafa Benzarti, Helmi Ben Saad (Author)

607-608

PDF

Browse

Categories

A - Basic Sciences

B - Clinical Sciences

C - Case Reports

D - Dental Sciences

E - Public Health

F - Review Articles

G - Nursing

T - Thematic Issues

T1 - "Coronavirus Disease (COVID-19)"

T2 - "Public Health and Nutrition Sciences in the Current Millennial Era"

T3 - "Neuroscience, Neurology, Psychiatry and General Medicine"

T4 - "Contribution of Nurses on Sustainable Development Goals (SDGs)"

T5 - "Re-Advancing Nursing Practice, Education and Research in the Post Covid"

T6 - "The Chalenges and Opportunities for Nurses in The New Era Adaptation"

T7 - "Neuroscience, Neurology, Psychiatry and Other Health Sciences - 2022"

T8 -"APHNI: Health Improvement Strategies Post Pandemic Covid-19"

Announcements

Happy New 2023 Year!

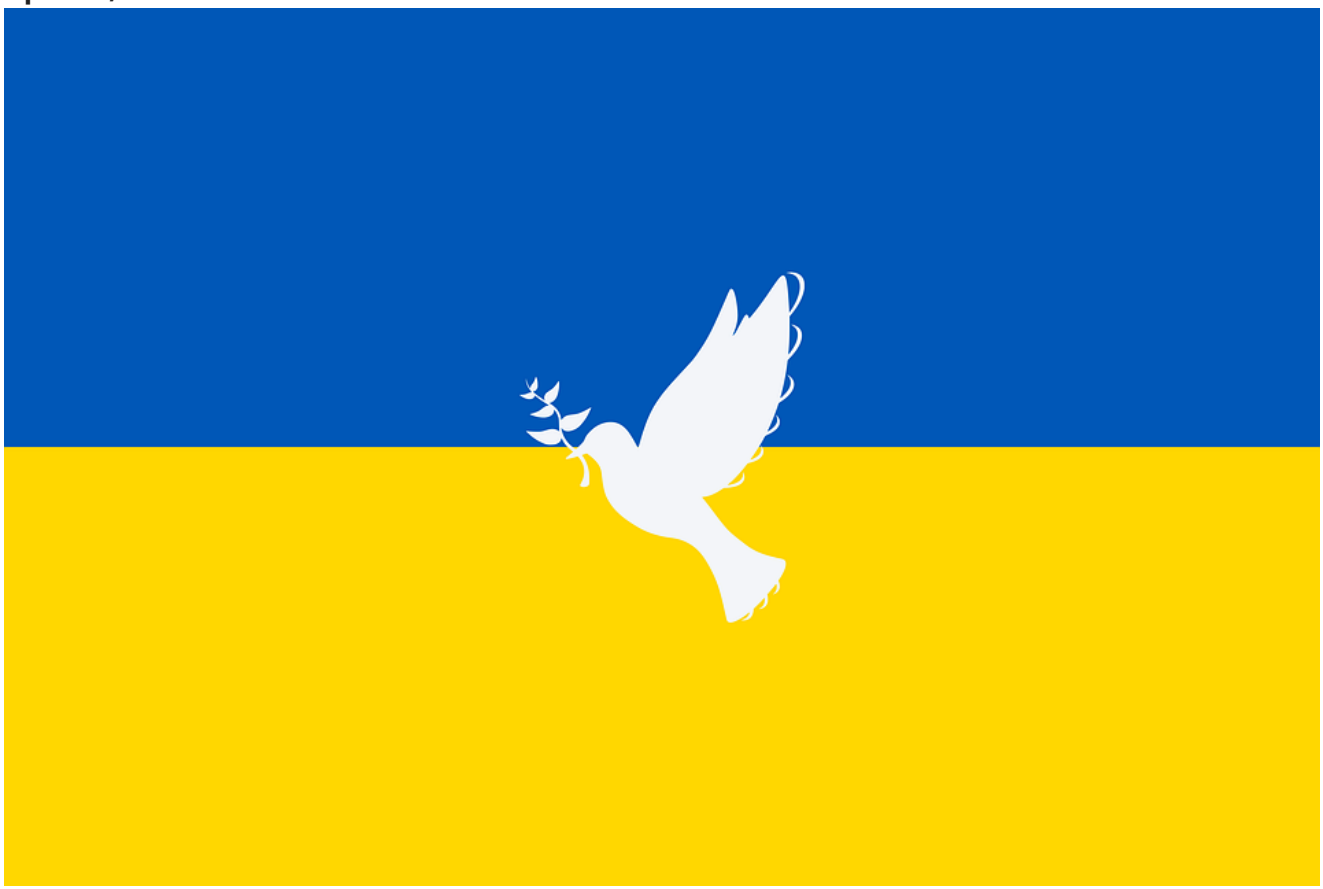
January 1, 2023

Dear member,

On behalf of Scientific Foundation SPIROSKI and Open Access Macedonian Journal of Medical Sciences (OAMJMS), we wish you Happy New 2023 Year.

Reduced Publication Fee for Ukraine

April 22, 2022



Open Access Macedonian Journal of Medical Sciences decided to support scientific community from Ukraine with reduction of Publication Fee from 400 € (EUR) to 200 € (EUR) till the end of the war.

Information

For Readers

For Authors

For Librarians

PKP Publishing Services

Part of the
PKP Publishing Services Network

Platform &
workflow by
OJS / PKP

Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2022 Feb 07; 10(F):146-152.
https://doi.org/10.3889/oamjms.2022.8148
eISSN: 1857-9655
Category: *F - Review Articles*
Section: *Narrative Review Article*

OPEN ACCESS

Chairless Chairs for Orthopedic Surgery Purpose – A Literature Review

Gatot Santoso[1,2], S. Sugiharto[1], Abdul Mughni[3], Muhammad Imam Ammarullah[2,4]*, Athanasius P. Bayuseno[2], J. Jamari[2,4]

[1]Department of Mechanical Engineering, Faculty of Engineering, Pasundan University, Bandung, Indonesia; [2]Department of Mechanical Engineering, Faculty of Engineering, Diponegoro University, Semarang, Indonesia; [3]Department of Surgery, Faculty of Medicine, Diponegoro University, Semarang, Indonesia; [4]Undip Biomechanics Engineering and Research Centre (UBM-ERC), Diponegoro University, Semarang, Indonesia

Edited by: Ksenija Bogoeva-Kostovska
Citation: Santoso G, Sugiharto S, Mughni A, Ammarullah MI, Bayuseno AP, Jamari J. Chairless Chairs for Orthopedic Surgery Purpose – A Literature Review. Open Access Maced J Med Sci. 2022 Feb 07; 10(F):146-152. https://doi.org/10.3889/oamjms.2022.8148
Keywords: Chairless chair; Orthopaedic surgery; Musculoskeletal disorders
***Correspondence:** Muhammad Imam Ammarullah, Department of Mechanical Engineering, Faculty of Engineering, Diponegoro University, Semarang 50275, Central Java, Indonesia.
E-mail: imamammarullah@gmail.com
Received: 03-Dec-2021
Revised: 20-Jan-2022
Accepted: 28-Jan-2022

Funding: The research was funded by Directorate of Research and Community Services, Republic of Indonesia No. 118-23/UN7.6.1/PP/2021.
Competing Interests: The authors have declared that no competing interests exist

Abstract

Musculoskeletal disorders are often found in various types of work, including surgeons. Standing working position is immobile and rigid when performing surgical operations. The equipment used is less ergonomic which is the main parameter. The surgeon profession belongs to the category of the high-risk profession and has the potential to experience musculoskeletal disorders. Surgeons who suffer musculoskeletal disorders sense disease start from mild-to-severe due to the muscles receiving static loads frequently in the long-term. The emergence of musculoskeletal disorders can be caused by working environment conditions and standing position while working, causing injury to joints, vertebral discs, nerves, cartilage, tendons, and muscles. This paper describes in extensive the potential for reducing musculoskeletal problems with the use of a chairless chair for surgeons in carrying out operations. Musculoskeletal problems in surgery and the use of chairless chairs have been further explored to close the existing research gap.

Introduction

Work activity will cause a tiring body. As in an industry, one of which is in the production section of the workers working long hours dominantly standing, which can cause musculoskeletal disorders [1]. Musculoskeletal disorders are diseases that cause prolonged pain. Someone who suffers from musculoskeletal disorders feels complaints ranging from mild-to-severe if the muscles receive static loads repeatedly and for a long time [2], [3], [4]. The emergence of musculoskeletal disorders is related to the conditions of the work environment and the way of working it supports so that with these conditions, it can cause damage to muscles, nerves, tendons, joints, cartilage, and vertebral discs [5]. Musculoskeletal disorders often occur in health practitioners. This happens because the position of the body when working is less ergonomic and occurs for a long time and repeatedly.

Among health practitioners who are vulnerable in facing the threat of musculoskeletal disorders are surgeons [6], [7]. In general, the type of work of a surgeon is characterized by a static and rigid body position in treating patients. Patients who are treated in an operating chair cause a surgeon to sit or stand bent over for a long time. This body position causes the practicing surgeon to often experience pain or discomfort in the neck, shoulders, and spine, which can result in, among other things, musculoskeletal disorders in the form of the lower back pain [8].

One of the causes of musculoskeletal disorders in surgeons is because orthopedic surgery only pays attention to comfort for the patients being treated, but does not pay attention to comfort for themselves when caring for their patients [9], [10], [11]. Surgeons assume that they must move toward the patient, rather than adjust the patient's sitting position on the operating chair. Most musculoskeletal disorders occur because the surgeon is unconsciously in an unsupportive body position when treating a patient [12].

During operating procedures on a patient, the surgeon sometimes bends over to the patient, moves

abruptly, and turning the body from side to side. All movements are repeated over a long time. It would cause musculoskeletal syndrome. Although working in a normal position can reduce or prevent the possibility of a musculoskeletal syndrome, most surgeons do not realize the importance of a well-positioned ergonomic system when treating patients [13], [14]. A good and correct posture requires good equipment too, for example, the ergonomic shape of the chair for the operator can support the spine in a comfortable position.

This paper will discuss the prevention of musculoskeletal disorders in orthopedic surgery with an ergonomic system, including the position of the surgeon, the position of the patient, and the equipment in the practice room.

Ergonomics Problems for Surgeons

The position of the surgical team on the operating table as presented in Figure 1 varies depending on the habits and comfort of each hospital, generally, the surgeon (operator/chief surgeon) stands on the side of the operating table next to the instrument nurse (instrumentation/scrub nurse). The first assistant (assistant surgeon) stands in front of the operator and if there is a second assistant stands next to the first assistant in front of the instrumentation. Position changes are made if a retraction or maneuver is required for comfort. The surgical team can be in this position during the operation (4–8 h) and a standing position [15].

A work position is a posture that is formed naturally by the worker's body that interacts with work habits and facilities used in a job. The design of a work position and ergonomic work facilities need to be provided to prevent fatigue due to the work position and provide comfort and not reduce concentration during work [16]. Ergonomics are the science of the relationship between humans, the equipment used, and the work environment. An ergonomic work position is a work position that harmonizes between workers, types of work, and the environment [17]. Some things must be considered concerning body position in doing work, namely, a) all work should be done in a sitting position or standing position alternately, b) all unnatural body positions must be avoided, if this is not possible, efforts should be made so that the load reduced static, and c) the seat must be made in such a way that it does not burden but can provide relaxation to the muscles that are not used for work and do not cause stress on the back, waist, and thighs [18], [19], [20], [21], [22].

Humans are designed to walk on two legs, but they are not designed to stand still for long periods. In humans, the center of gravity of the body is located above or close to the joints, so that when bending over,

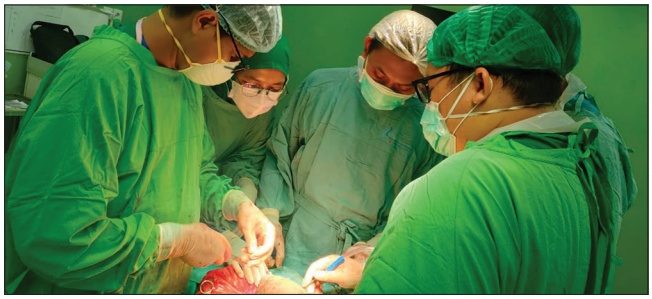


Figure 1: Surgeon position during operation

the standing position can be maintained with minimal muscle activity [23], [24], [25], [26]. The surgeon when doing work is in a standing position that is less ergonomic because the surgeon has to bend over so that the load on the muscles becomes large [27]. In addition, the surgeon's right foot when working must step on the foot pedal so that the weight of the body is centered on the left foot as shown in Figure 2.

The Use of Exoskeletons to Assist Human Activities

The concept and potential of the exoskeleton have been introduced and proposed for helping, supporting, and protecting a person's body in carrying out certain activities in the long-term [28]. In this context, the exoskeleton refers to a component that can expand or increase a person's physical abilities throughout the user [29]. Exoskeletons are also commonly referred to as wearable robots, super suits, or exosuits because the difference from robots, in general, makes these components that have an outer skeleton or shell that can be used on the human body [30], [31], [32]. The movement of the exoskeleton is expected to be able to follow the movements of the user with sophisticated position or force sensors with capable actuator control and signal processing.

Exoskeletons increase the wearer's ability to move and carry faster and heavier loads by exhibiting higher perseverance. The augmentation capability makes it meet needs in a wide range of military [33] industrial [34], and medical applications [35]. Then, for the construction industry, a full-body exoskeleton with multiple motors and an electrical system can turn the wearer become a superior workforce adequate of lift and manipulate more than 200 pounds safely [36]. Partially motorized exoskeleton suits, such as fitted arm exosuits [37] and chairless chairs [38], can reduce repetitive stress and muscle injury from repetitive arm movement and/or standing statically in the same position for long periods. Even passive exoskeletons, without the use of actuators, motors, or batteries, can still improve worker safety and reduce fatigue through sprint and counterweight technology [39]. Although it has great potential, a complete

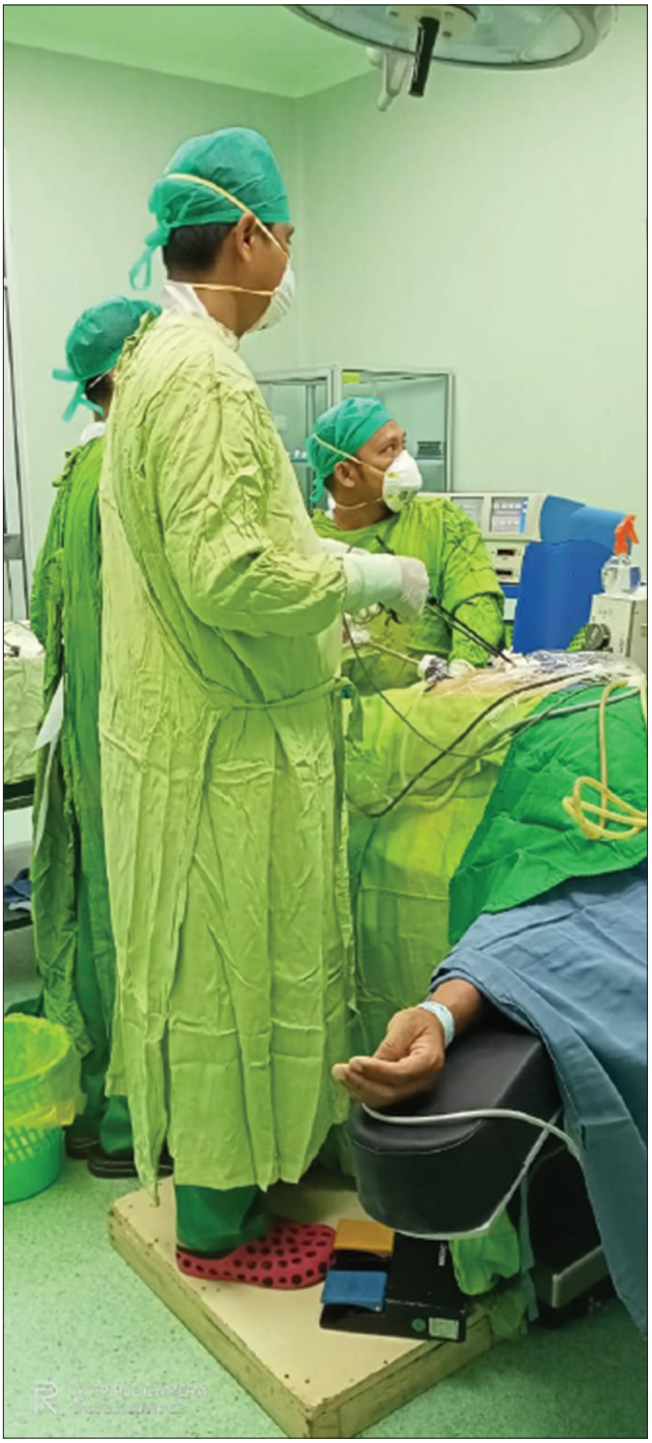


Figure 2: The surgeon's right foot position during work

understanding of the status quo is still lacking in keeping up with the present external framework technology trends among the construction research community. This understanding has contributed greatly to the infiltration of the exoskeleton in the construction.

Exoskeletons are made with the aim of assisting with carrying, overhead, static holding, lifting, and other work activities. This tool provides convenience for the user by providing increased ability, strengthening endurance, and minimizing overly tense muscles, to enhance global work productivity and efficiency. From the previous literature, Huysamen *et al*. [40] provide and evaluate a passive exoskeleton to support the upper extremities during static overhead work and reduce the risk of work-related musculoskeletal disorders. Furthermore, Elisheba *et al*. [41] designed chairless chairs to provide comfort for workers who need to work in awkward positions, such as bending over, crouching, and standing, for long periods.

In general, exoskeletons are classified into two types based on the use of a power supply to support the functions of the exoskeleton which are described in Table 1. Exoskeletons are categorized as "passive" if the product or prototype is supported by natural human movement through springs or counterweights. Meanwhile, the exoskeleton is categorized as "active" if the product or prototype is supported by an electric system, levers, pneumatic, hydraulic, or a combination of these technologies.

Table 1: Type of exoskeleton to help works in the legs area

Category	Type of Exoskeleton	Benefits provided from the previous studies
Passive	Chairless Chair [42], [43]	Reduce muscle stiffness in the lower half of the human body
	LegX [44]	Reduce rectus femoris and knee extensor
Active	Angel suit [45]	Reduce variation of pressure movement to balancing
	UMEx-oLEA [46]	Give torque assist and minimize muscular stress

Chairless Chair as a Solution to Ergonomics Problems

Chairless chair is a "chair" that is an article of exoskeleton-like clothing, which allows the user to walk or move at a certain speed according to the device used while working as shown in Figure 3. This chair also helps to rest the leg muscles when working for a long time, and this innovative new chair helps comfort the thighs and back. Therefore, this tool will help increase productivity for workers who work long hours when the job is more dominant working standing. The working principle of this chairless chair is to use a hydraulic system which is a form of change or transfer of power using a conducting medium in the form of a liquid fluid to obtain a power greater than the initial power issued, where when the user sits down, the hydraulic will automatically withstand the body force that the tool wraps around the thigh, so it will reduce user fatigue and increase productivity. Several previous studies on chairless chairs are shown in Table 2.

Chairless chairs are designed primarily for people who stand for long periods and experience fatigue in the lumbar region, where there are pain from the hips to the legs [55]. This is experienced by surgeons who stand and operate their wards for some. Using this chairless chair will increase the efficiency of the workers and also indirectly increase the productivity of the organization or company where they work [56]. It reduces their fatigue and stress by providing a perfect

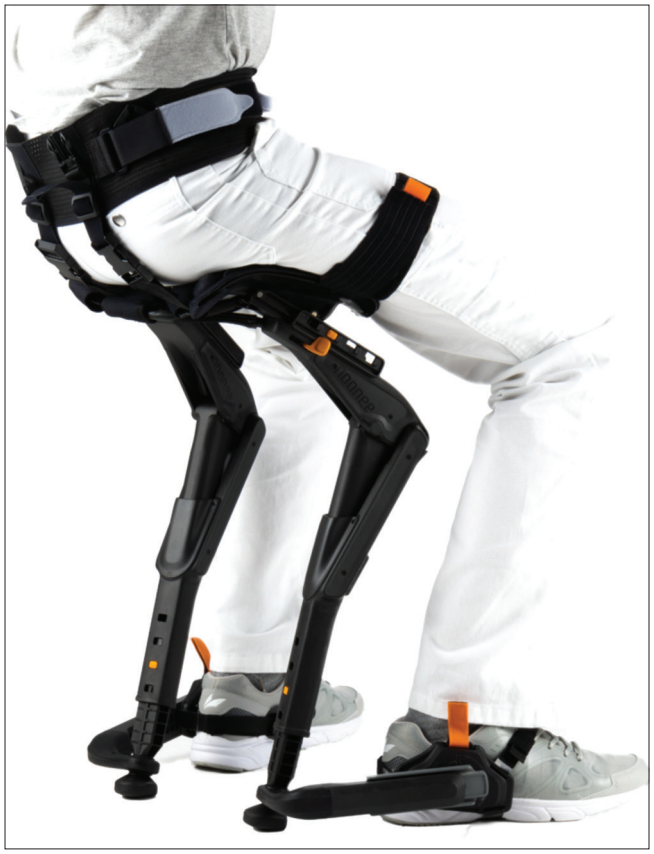


Figure 3: Chairless chair. Picture adapted from: https://www.noonee.com/(© noonee AG)

working posture to the workers. Conventional chairs cannot be carried anywhere because of static, but this chairless chair is a wearable ergonomic therapy device [57], [58], [59]. Anyone can use it anywhere and anytime according to their needs and uses. The provision of conventional chairs will make workers rest longer but by providing chairs without chairs, workers will not rest much and work efficiently which will increase company productivity [60], [61]. Innovations have been made to use chairless chair for the purpose of the medical field, where surgeons account it in operation. Physiotherapists in rehabilitating people suffering from back pain due to illness, trauma, or any deficiency can also use a chairless chair.

Many musculoskeletal disorders are complained about by workers in factories that do not provide adequate rest, so many researchers are looking for ways to overcome them [62], [63] [64]. Musculoskeletal disorders that include the upper and lower spine, shoulders, and wrists are risk factors for the surgeon profession [65]. In several previous studies, it is known that the prevalence of musculoskeletal disorders among surgeons ranges from 25% to 85% [66], [67], [68]. Several technical factors such as surgical units, work lights, and other equipment used are not ergonomic and non-technical factors such as the way and position when treating patients and the surgeon's lifestyle are risks that play an important role in the occurrence of musculoskeletal disorders in surgeons [69], [70], [71], [72], [73], [74]. Improving technical and non-technical risk factors can be done to prevent musculoskeletal disorders in surgeons.

Technical factors include improved by sitting position, standing position when treating patients, and ergonomic equipment (desk, surgical unit, and work lamp). Teamwork between surgeons and trained assistants handles the equipment so that the surgeon only concentrates on patient care [75], [76], [77], [78]. Non-technical factors such as time lag between one patient and another patient to rest their muscles, as well as a large practice room, need to be considered [79], [80]. Several preventive measures that are not related to the equipment used have a key role in reducing the incidence of musculoskeletal disorders in surgeons.

Table 2: Research related to the chairless chair

Authors	Research findings
Bridger *et al.* [47]	Influence of the exoskeleton on the lower limbs when squatting
Capitani *et al.* [48]	Developing an exoskeleton to help construction workers
Elisheba *et al.* [41]	Design a chairless chair to reduce back pain in workers
Ippolito [49]	Optimizing the workplace using integrated exoskeleton technology
Irawan [50]	Design and manufacture chairless chairs based on local components
Kurnia [51]	Carry out the design and manufacture of chairless chair prototypes
Luger *et al.* [42], [43]	Simulates the physical load, posture, and discomfort of using an exoskeleton in industrial workers
Mogare *et al.* [52]	Develop a chairless chair that can be used by workers to work in a sitting and standing position
Siddha *et al.* [53]	Develop a chairless chair to reduce musculoskeletal disorder in the industrial field
Yan *et al.* [54]	Developing an exoskeleton to help workers in an industry
Zhu *et al.* [36]	Classifying exoskeletons that can be used in various types of work

Conclusion

The use of chairless chairs in orthopedic surgery has great potential to minimize muscle stiffness and problems with the musculoskeletal system. The activity of standing for a long time during surgery and various patient-focused positions makes the surgeon's condition less ergonomic. The previous works of the literature have also supported the use of chairless chairs as a type of exoskeleton in facilitating human activities in various aspects, such as military, industrial, and medical. Further development of the chairless chair in its application in the world of orthopedics needs to be developed in the future.

Acknowledgment

The research was funded by research grant from Pasundan University and World Class Research UNDIP number 118-23/UN7.6.1/PP/2021. Muhammad Imam Ammarullah gratefully acknowledges Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) and Indonesia Endowment Fund

for Education (LPDP) for domestic master degree of Indonesian education scholarships (BPI) under number 0693/J5.2.3./BPI.06/10/2021.

References

1. Nourollahi-Darabad M, Afshari D, Dianat I, Jodakinia L. Long-duration assessment of upper arm posture and motion and their association with perceived symptoms among bakery workers. Int J Ind Ergon. 2020;80:103029. https://doi.org/10.1016/j.ergon.2020.103029
2. Ambarwati T, Suroto S, Wicaksana B, Sopianah Y, Miko H. Posture work to complaint musculoskeletal disorders at the dentist. J Int Dent Med Res. 2018;11(1):57-61.
3. Ammarullah MI, Afif IY, Maula MI, Winarni TI, Tauviqirrahman M, Jamari J. Tresca stress evaluation of Metal-on-UHMWPE total hip arthroplasty during peak loading from normal walking activity. Mater. Today Proc (article in press). https://doi.org/10.1016/j.matpr.2022.02.055
4. Ammarullah MI, Afif IY, Maula MI, Winarni TI, Tauviqirrahman M, Bayuseno AP, *et al*. 2D computational tresca stress prediction of CoCrMo-on-UHMWPE bearing of total hip prosthesis based on body mass index. Malaysian J Med Health Sci. 2021;17 Suppl 13:18-21. Available from: https://www.medic.upm.edu.my/jurnal_kami/malaysian_journal_of_medicine_and_health_sciences_mjmhs/mjmhs_vol17_supp_13_december_2021-64714. [Last accessed on 2021 Sep 23].
5. Jaffar N, Abdul-Tharim AH, Mohd-Kamar IF, Lop NS. A literature review of ergonomics risk factors in construction industry. Procedia Eng. 2011;20:89-97.
6. Memon AG, Naeem Z, Zaman A, Zahid F. Occupational health related concerns among surgeons. Int J Health Sci (Qassim). 2016;10(2):279-91.
   PMid:27103909
7. Epstein S, Sparer EH, Tran BN, Ruan QZ, Dennerlein JT, Singhal D, *et al*. Prevalence of work-related musculoskeletal disorders among surgeons and interventionalists: A systematic review and meta-analysis. JAMA Surg. 2018;153(2):e174947. https://doi.org/10.1001/jamasurg.2017.4947
   PMid:29282463
8. Stomberg MW, Tronstad SE, Hedberg K, Bengtsson J, Jonsson P, Johansen L, *et al*. Work-related musculoskeletal disorders when performing laparoscopic surgery. Surg Laparosc Endosc Percutan Tech. 2010;20(1):49-53. https://doi.org/10.1097/SLE.0b013e3181cded54
   PMid:20173622
9. Lavé A, Gondar R, Demetriades AK, Meling TR. Ergonomics and musculoskeletal disorders in neurosurgery: A systematic review. Acta Neurochir (Wien). 2020;162(9):2213-20. https://doi.org/10.1007/s00701-020-04494-4
   PMid:32705353
10. Mündermann A, Nigg BM, Humble RN, Stefanyshyn DJ. Orthotic comfort is related to kinematics, kinetics, and EMG in recreational runners. Med Sci Sports Exerc. 2003;35(10):1710-9. https://doi.org/10.1249/01.MSS.0000089352.47259.CA
    PMid:14523309
11. Mahendra NY, Putra DP, Akbar I, Putra RU, Prakoso AT, Yanis M, et al. Narrative Review of Subchondral Bone Morphology on Cartilage Damage (Osteoarthritis). Proc. 5th FIRST T1 T2 2021 Int. Conf. (FIRST-T1-T2 2021). 2022;9:77–82. https://doi.org/10.2991/ahe.k.220205.014
12. Jain NB, Higgins LD, Losina E, Collins J, Blazar PE, Katz JN. Epidemiology of musculoskeletal upper extremity ambulatory surgery in the United States. BMC Musculoskelet Disord. 2014;15(1):4. https://doi.org/10.1186/1471-2474-15-4
    PMid:24397703
13. Johanning E. Evaluation and management of occupational low back disorders. Am J Ind Med. 2000;37(1):94-111. https://doi.org/10.1002/(sici)1097-0274(200001)37:1<94:aid-ajim8>3.0.co;2-x
    PMid:10573599
14. Rosenblatt PL, McKinney J, Adams SR. Ergonomics in the operating room: Protecting the surgeon. J Minim Invasive Gynecol. 2013;20(6):744. https://doi.org/10.1016/j.jmig.2013.07.006
    PMid:23969139
15. Yasuhara T, Kuwahara K, Sasada S, Toyoshima A, Morimoto J, Kin K, *et al*. Surgery in the standing position by a surgeon with achilles tendon rupture. Acta Med Okayama. 2016;70(6):493-6. https://doi.org/10.18926/AMO/54813
    PMid:28003675
16. Maula MI, Aji AL, Aliyafi MB, Afif IY, Ammarullah MI, Winarni TI, *et al*. The subjective comfort test of autism hug machine portable seat. J Intellect Disabil. 2021;9(2):182-8. https://doi.org/10.6000/2292-2598.2021.09.02.4
17. Jafry T, O'Neill DH. The application of ergonomics in rural development: A review. Appl Ergon. 2000;31(3):263-8. https://doi.org/10.1016/s0003-6870(99)00051-4
    PMid:10855449
18. Berguer R, Smith W. An ergonomic comparison of robotic and laparoscopic technique: The influence of surgeon experience and task complexity. J Surg Res. 2006;134(1):87-92. https://doi.org/10.1016/j.jss.2005.10.003
    PMid:16376941
19. Sers R, Forrester S, Zecca M, Ward S, Moss E. The ergonomic impact of patient body mass index on surgeon posture during simulated laparoscopy. Appl Ergon. 2021;97:103501. https://doi.org/10.1016/j.apergo.2021.103501
    PMid:34167015
20. Matern U. Principles of ergonomic instrument handles. Minim Invasive Ther Allied Technol. 2001;10(3):169-73. https://doi.org/10.1080/136457001753192295
    PMid:16754010
21. Ammarullah MI, Afif IY, Maula MI, Winarni TI, Tauviqirrahman M, Akbar I, *et al*. Tresca stress simulation of metal-on-metal total hip arthroplasty during normal walking Activity. Materials (Basel). 2021;14(24):7554. https://doi.org/10.3390/ma14247554
    PMid:34947150
22. Afif IY, Farkhan M, Kurdi O, Maula MI, Ammarullah MI, Setiyana B, *et al*. Effect of short-term deep-pressure portable seat on behavioral and biological stress in children with autism spectrum disorders: A pilot study. Bioengineering. 2022;9(2):48. https://doi.org/10.3390/bioengineering9020048
    PMid:35200402
23. Ammarullah MI, Saad APM, Syahrom A, Basri H. Contact pressure analysis of acetabular cup surface with dimple addition on total hip arthroplasty using finite element method. IOP Conf Ser Mater Sci Eng. 2021;1034(1):1-11. https://doi.org/10.1088/1757-899X/1034/1/012001
24. Jamari J, Ammarullah MI, Saad APM, Syahrom A, Uddin M, Heide E van der, *et al*. The Effect of Bottom Profile Dimples on the Femoral Head on Wear in Metal-on-Metal Total Hip Arthroplasty. J Funct Biomater. 2021;12(2):38. https://doi.org/10.3390/jfb12020038
25. Basri H, Syahrom A, Prakoso AT, Wicaksono D, Amarullah MI, Ramadhoni TS, *et al*. The Analysis of Dimple Geometry on Artificial Hip Joint to the Performance of Lubrication. J Phys Conf Ser. 2019;1198(4):1-10.

https://doi.org/10.1088/1742-6596/1198/4/042012

26. Basri H, Syahrom A, Ramadhoni TS, Prakoso AT, Ammarullah MI, Vincent. The analysis of the dimple arrangement of the artificial hip joint to the performance of lubrication. IOP Conf Ser Mater Sci Eng. 2019;620(1):1-10. https://doi.org/10.1088/1757-899X/620/1/012116
27. Schlussel AT, Maykel JA. Ergonomics and musculoskeletal health of the surgeon. Clin Colon Rectal Surg. 2019;32(6):424-34. https://doi.org/10.1055/s-0039-1693026

    PMid:31686994
28. Rupal BS, Rafique S, Singla A, Singla E, Isaksson M, Virk GS. Lower-limb exoskeletons: Research trends and regulatory guidelines in medical and non-medical applications. Int J Adv Robot Syst. 2017;14(6):1-27. https://doi.org/10.1177/1729881417743554
29. Pawar MV, Ohol SS, Patil A. Modelling and development of compressed air powered human exoskeleton suit human exoskeleton. In: 2018 7th International Conference on Reliability, Infocom Technologies and Optimization Trends Futur Dir, ICRITO 2018; 2018. p. 861-6.
30. Jamari J, Ammarullah MI, Afif IY, Ismail R, Tauviqirrahman M, Bayuseno AP. Running-in analysis of transmission gear. Tribol Ind. 2021;43(3):434-41. https://doi.org/10.24874/ti.1092.04.21.08
31. Kang I, Hsu H, Young A. The effect of hip assistance levels on human energetic cost using robotic hip exoskeletons. IEEE Robot Autom Lett. 2019;4(2):430-7.
32. Kapsalyamov A, Jamwal PK, Hussain S, Ghayesh MH. State of the art lower limb robotic exoskeletons for elderly assistance. IEEE Access. 2019;7:95075-86.
33. Mudie KL, Boynton AC, Karakolis T, O'Donovan MP, Kanagaki GB, Crowell HP, *et al*. Consensus paper on testing and evaluation of military exoskeletons for the dismounted combatant. J Sci Med Sport. 2018;21(11):1154-61. https://doi.org/10.1016/j.jsams.2018.05.016

    PMid:30318056
34. Spada S, Ghibaudo L, Gilotta S, Gastaldi L, Cavatorta MP. Investigation into the applicability of a passive upper-limb exoskeleton in automotive industry. Procedia Manuf. 2017;11:1255-62. https://doi.org/10.1016/j.promfg.2017.07.252
35. Kagirov I, Kapustin A, Kipyatkova I, Klyuzhev K, Kudryavcev A, Kudryavcev I, *et al*. Medical exoskeleton "Remotion" with an intelligent control system: Modeling, implementation, and testing. Simul Model Pract Theory. 2021;107:102200. https://doi.org/10.1016/j.simpat.2020.102200
36. Zhu Z, Dutta A, Dai F. Exoskeletons for manual material handling-a review and implication for construction applications. Autom Constr. 2021;122:103493. https://doi.org/10.1016/j.autcon.2020.103493
37. Liu S, Hemming D, Luo RB, Reynolds J, Delong JC, Sandler BJ, *et al*. Solving the surgeon ergonomic crisis with surgical exosuit. Surg Endosc. 2018;32(1):236-44. https://doi.org/10.1007/s00464-017-5667-x

    PMid:28643066
38. Noone. Chairless Chair 2.0-Die Neue Generation, Noone; 2021. Available from: https://www.noonee.com [Last accessed on 2021 Sep 01].
39. Wang Z, Wu X, Zhang Y, Chen C, Liu S, Liu Y, *et al*. A semi-active exoskeleton based on emgs reduces muscle fatigue when squatting. Front Neurorobot. 2021;15:625479. https://doi.org/10.3389/fnbot.2021.625479

    PMid:33889081
40. Huysamen K, de Looze M, Bosch T, Ortiz J, Toxiri S, O'Sullivan LW. Assessment of an active industrial exoskeleton to aid dynamic lifting and lowering manual handling tasks. Appl Ergon. 2018;68:125-31. https://doi.org/10.1016/j.apergo.2017.11.004

    PMid:29409626
41. Elisheba DD, Britto Y, Christina VP. CHair-less chair for lumbar pain reduction. Int J Mech Eng Technol. 2018;9(11):500-7.
42. Luger T, Seibt R, Cobb TJ, Rieger MA, Steinhilber B. Influence of a passive lower-limb exoskeleton during simulated industrial work tasks on physical load, upper body posture, postural control and discomfort. Appl Ergon. 2019;80:152-60. https://doi.org/10.1016/j.apergo.2019.05.018

    PMid:31280799
43. Luger T, Cobb TJ, Seibt R, Rieger MA, Steinhilber B. Subjective evaluation of a passive lower-limb industrial exoskeleton used during simulated assembly. IISE Trans Occup Ergon Hum Factors. 2019;7(3-4):175-84.
44. Pillai MV, van Engelhoven L, Kazerooni H. Evaluation of a lower leg support exoskeleton on floor and below hip height panel work. Hum Factors. 2020;62(3):489-500. https://doi.org/10.1177/0018720820907752

    PMid:32150477
45. Jeong M, Woo H, Kong K. A study on weight support and balance control method for assisting squat movement with a wearable robot, angel-suit. Int J Control Autom Syst. 2020;18(1):114-23.
46. Sado F, Yap HJ, Ghazilla RAR, Ahmad N. Design and control of a wearable lower-body exoskeleton for squatting and walking assistance in manual handling works. Mechatronics. 2019;63:102272. https://doi.org/10.1016/j.mechatronics.2019.102272
47. Bridger RS, Ashford AI, Wattie S, Dobson K, Fisher I, Pisula PJ. Sustained attention when squatting with and without an exoskeleton for the lower limbs. Int J Ind Ergon. 2018;66:230-9. https://doi.org/10.1016/j.ergon.2018.03.005
48. Capitani SL, Bianchi M, Secciani N, Pagliai M, Meli E, Ridolfi A. Model-based mechanical design of a passive lower-limb exoskeleton for assisting workers in shotcrete projection. Meccanica. 2021;56(1):195-210. https://doi.org/10.1007/s11012-020-01282-3
49. Ippolito D, Constantinescu C, Riedel O. Holistic planning and optimization of human-centred workplaces with integrated Exoskeleton technology. Procedia CIRP. 2020;88:214-7. https://doi.org/10.1016/j.procir.2020.05.038
50. Irawan AP, Utama DW, Affandi E, Michael M, Suteja H. Product design of chairless chair based on local components to provide support for active workers. IOP Conf Ser Mater Sci Eng. 2019;508(1):1-6.
51. Kurnia AF. Rancang Bangun Chairless Chair. Indonesia: Pasundan University; 2018.
52. Mogare MR, Sravasti SS, Ashtekar RV, Sovani GC. Research paper on VIRTUAL CHAIR: An exoskeleton. Int Res J Eng Technol. 2017;4(5):2328-35.
53. Siddha B, Biradar V, Darwatkar V, Shubham D, Suresh W. Chairless chair. Int J Res Appl Sci Eng Technol. 2018;5(6):218-21.
54. Yan Z, Han B, Du Z, Huang T, Bai O, Peng A. Development and testing of a wearable passive lower-limb support exoskeleton to support industrial workers. Biocybern Biomed Eng. 2021;41(1):221-38. https://doi.org/10.1016/j.bbe.2020.12.010
55. Magdum RM, Jadhav SM. Design and implementation of chair less seating arrangement for industrial workers and farmers. Glob Res Dev J Eng. 2018;3(8):5-11.
56. Houben BH. Satisfaction with the Physical Working Environment. Netherlands: Eindhoven University of Technology; 2015.
57. Choi J. Application of assistive wearable robotics to alleviate construction workforce shortage: Challenges and opportunities. In: ASCE International Workshop on Computing in Civil Engineering; 2017. p. 358-65.
58. Tarun D, Srikanth VM, Kumar RJ, Anudeep IM, Srikanth S. Stress analysis on a chairless chair. Int J Theor Appl Mech. 2017;12(4):699-708.

59. Naidu TY. Design and improvement of lower body exoskeleton. Mech Syst Des. 2016;5:1-8.
60. Prall J, Ross M. The management of work-related musculoskeletal injuries in an occupational health setting: The role of the physical therapist. J Exerc Rehabil. 2019;15(2):193-9. https://doi.org/10.12965/jer.1836636.318
PMid:31111000
61. Ellegast RP, Kraft K, Groenesteijn L, Krause F, Berger H, Vink P. Comparison of four specific dynamic office chairs with a conventional office chair: Impact upon muscle activation, physical activity and posture. Appl Ergon. 2012;43(2):296-307. https://doi.org/10.1016/j.apergo.2011.06.005
PMid:21714953
62. Carrillo-Castrillo JA, Pérez-Mira V, Del Carmen Pardo-Ferreira M, Rubio-Romero JC. Analysis of required investigations of work-related musculoskeletal disorders in Spain. Int J Environ Res Public Health. 2019;16(10):1682. https://doi.org/10.3390/ijerph16101682
PMid:31091722
63. Choi M, Kim HR, Lee J, Lee HE, Byun J, Won JU. Workers' experiences with compensated sick leave due to musculoskeletal disorder: A qualitative study. Ann Occup Environ Med. 2014;26(1):33. https://doi.org/10.1186/s40557-014-0033-0
PMid:25852943
64. Tuncel S, Genaidy A, Shell R, Salem S, Karwowski W, Darwish M, *et al*. Research to practice: Effectiveness of controlled workplace interventions to reduce musculoskeletal disorders in the manufacturing environment-critical appraisal and meta-analysis. Hum Factors Ergon Manuf. 2008;18(2):93-124.
65. Abidin Z, Fadhlurrahman IG, Akbar I, Putra RU, Prakoso AP, Kadir MZ, et al. Numerical Investigation of the Mechanical Properties of 3D Printed PLA Scaffold. Proc. 5th FIRST T1 T2 2021 Int. Conf. (FIRST-T1-T2 2021). 2022;9: 83-89. https://doi.org/10.2991/ahe.k.220205.015
66. Patel MS, Lee KC, Dhake RP, Longworth S, Sell P. Ability of spine specialists to identify psychosocial risk factors as obstacles to recovery in patients with low back pain-related disorders. Asian Spine J. 2021;15(2):224-33. https://doi.org/10.31616/asj.2019.0377
PMid:32703922
67. Roudsari B, Jarvik JG. Lumbar spine MRI for low back pain: Indications and yield. Am J Roentgenol. 2010;195(3):550-9. https://doi.org/10.2214/AJR.10.4367
PMid:20729428
68. Fayad F, Lefevre-Colau MM, Gautheron V, Macé Y, Fermanian J, Mayoux-Benhamou A, *et al*. Reliability, validity and responsiveness of the French version of the questionnaire quick disability of the arm, shoulder and hand in shoulder disorders. Man Ther. 2009;14(2):206-12. https://doi.org/10.1016/j.math.2008.01.013
PMid:18436467
69. Shaik A, Sripathi Rao B, Husain A, D'sa J. Work-related musculoskeletal disorders among dental surgeons: A pilot study. Contemp Clin Dent. 2011;2(4):308-12. https://doi.org/10.4103/0976-237X.91794
PMid:22346158
70. Rafie F, Jam AZ, Shahravan A, Raoof M, Eskandarizadeh A. Prevalence of upper extremity musculoskeletal disorders in dentists: Symptoms and risk factors. J Environ Public Health. 2015;2015:517346. https://doi.org/10.1155/2015/517346
PMid:26064141
71. Ganer N. Work Related Musculoskeletal Disorders Among Healthcare Professional and Their Preventive Measure: A Report. Vol. 4; 2016. p. 693-8.
72. Aghilinejad M, Ehsani AA, Talebi A, Koohpayehzadeh J, Dehghan N. Ergonomic risk factors and musculoskeletal symptoms in surgeons with three types of surgery: Open, laparoscopic, and microsurgery. Med J Islam Repub Iran. 2016;30(1):467.
PMid:28491842
73. Lin TH, Liu YC, Hsieh TY, Hsiao FY, Lai YC, Chang CS. Prevalence of and risk factors for musculoskeletal complaints among Taiwanese dentists. J Dent Sci. 2012;7(1):65-71. https://doi.org/10.1016/j.jds.2012.01.009
74. Akbar I, Prakoso AT, Astrada YM, Sinaga MS, Ammarullah MI, Adanta D, et al. Permeability Study of Functionally Graded Scaffold Based on Morphology of Cancellous Bone. Malaysian J Med Health Sci. 2021;17 Suppl 13:60-66.
75. Matern U. Ergonomic deficiencies in the operating room: Examples from minimally invasive surgery. Work. 2009;33(2):165-8. https://doi.org/10.3233/WOR-2009-0862
PMid:19713625
76. Lowndes BR, Hallbeck MS. Overview of human factors and ergonomics in the OR, with an emphasis on minimally invasive surgeries. Hum Factors Ergon Manuf. 2014;24(3):308-17.
77. Seetharaman R, Thattil RS, Visal P, Vijesh VM, Sanjay V. Design, Analysis and Development of Chairless Chair Exoskeleton System. Vol. 588. Kerala: Nehru College of Engineering and Research Center; 2018.
78. Shouhed D, Gewertz B, Wiegmann D, Catchpole K. Integrating human factors research and surgery: A review. Arch Surg. 2012;147(12):1141-6. https://doi.org/10.1001/jamasurg.2013.596
PMid:23248019
79. Yule S, Flin R, Paterson-Brown S, Maran N. Non-technical skills for surgeons in the operating room: A review of the literature. Surgery. 2006;139(2):140-9. https://doi.org/10.1016/j.surg.2005.06.017
PMid:16455321
80. Mishra A, Catchpole K, Dale T, McCulloch P. The influence of non-technical performance on technical outcome in laparoscopic cholecystectomy. Surg Endosc Other Interv Tech. 2008;22(1):68-73. https://doi.org/10.1007/s00464-007-9346-1
PMid:17479324