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The Artificial Intelligence Vs Physiotherapist Intervention on Therapeutic Alliance Based on Goal Setting and Task Agreement: An Rapid Review

Prof. Dr. Shanmugananth E[1], Prof. Dr Yu Chye Wah[2], Susmitha Govind[3] ,Kshtrashal Singh[4],

shankutty1981@gmail.com[1], chyewah@aimst.edu.my[2], Susmitha@aimst.edu.my[3] kshtrashal@aimst.edu.my[4]*

[1]School of Physiotherapy, Sree Balaji Vidyapeeth, Deemed to be University, India,

[2, 3]School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Malaysia,

[4]School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Malaysia and Ph.D Scholar, School of Physiotherapy, Sree Balaji Vidyapeeth, Deemed to be University, India

*Corresponding Author: kshtrashal@aimst.edu.my**

KEYWORDS

Artificial Intelligence, Physiotherapeutic Intervention, Therapeutic Alliance, Goal Setting, Task Agreement.

ABSTRACT

Introduction: AI technologies affecting the healthcare system in the current world, and the importance of compassion in providing quality healthcare and benefits the society, the authors aimed to find out the correlation in depth for the future shaping of healthcare. Their findings state that AI emphasized awareness, response, behaviour, communication, health coaching, therapeutic interventions, moral development of learning, clinical knowledge and assessment, therapeutic alliance, healthcare information, and advice.

Methods: This is a review of randomized controlled trial with single-blinded towards the participants. The experimental were received planned intervention from AI while the control group received the planned intervention by physiotherapists. The outcome measure are based on work alliance inventory (WAI)/ WAI-SF, items would be based on task items and goals items.

Discussion: The usage and risk of using AI in physiotherapy settings had also been studied. Park et al. (2023) carried out a random controlled trial assessing on long-term effects of deep learning (a branch of AI) digital physical therapy applications on pain, functional limitations, lower extremity weakness, radicular symptoms, range of motion limitation, functional movement, quality of life, cost-effectiveness and satisfaction with comparison to conventional physical therapy. The 4-week study draws the result of the digital-physical therapy applications having a similar effect to conventional physical therapy on structural and functional impairment, activity limitation, participation restriction and appears a superior result on clinical outcome measures, lower extremity strength and trunk mobility, activity of daily living, quality of life, and functional movement.

Conclusion: a higher therapeutic alliance score is more likely to meet the minimal clinical important difference based on patient-reported outcome measures for both disability and pain intensity. Besides, patients who scored higher therapeutic alliance scores will improve in changes of outcome measurements. Therefore, physiotherapists assess the therapeutic alliance and strategically improve the alliance for a better experience for patients in musculoskeletal rehabilitation.

Background of Research:

Artificial Intelligence (AI) is the engineering of computer science that allows the performance of tasks like human cognitive function by computer or machine. Despite AI gaining its population in the recent few years, it was first introduced in 1955. John McCarthy and his colleagues conducted a research project to produce human intelligence on a machine or computer with minimal human involvement. (Cheng et al., 2024) This research was fundamental to establishing the concept of AI, which led to the development and research of computer sciences. In the earlier stages, the accomplishment of AI was due to its ability to solve tasks that are easy to formulate or program but was challenging for human to execute. (Cheng et al., 2024; Rajkomar et al., 2019; Mintz et al., 2019) Machine learning is the first subset of AI which was introduced in 1959, it is the field that provides the most promising results in AI. (Cheng et al., 2024; Nogales et al., 2024) Machine Learning enables the computer to generate algorithms and behavioral models based on the input data, hence allowing it to learn and carry out decisions, hence allowing in the improvement of the experiences through progressive learning and adjustment of internal parameters. (Cheng et al., 2024) The adjusted process of machine learning required a large amount of data and involved three types of learning processes, supervised, unsupervised, and reinforcement. (Cheng et al., 2024; Nogales et al., 2024; Sidey-Gibbons & Sidey-Gibbons, 2019) Supervised learning requires the machine to interpret the labelled algorithm or data and match it to the output data. (Cheng et al, 2024; Razavian et al., 2020) In unsupervised learning, the algorithm required to find the patterns or structures of unlabelled data, so to find the potential hidden pattern which are not yet to be recognised by human. (Cheng et al., 2024; Cabitza et al., 2018) In reinforcement learning, the usage of rewarding and punishing was integrated, so to allow the algorithm or machine to learned to make the sequences. (Cheng et al., 2024; Brown & Sandholm, 2019) The black box phenomena, meanwhile explained that the way of decision-making and predictions which were difficult to answer by human despite the machine learning model making the correct and precise predictions and outcomes. (Cheng et al., 2024; Myers et al., 2020) Deep learning which was proposed during the 1980s, meanwhile is a highly advanced version of unsupervised machine learning. (Cheng et al., 2024) It was specifically designed for the interpretation of large data sets and can be used for tasks such as image classifications, object detection, and more. (Cheng et al., 2024; Jiang et al., 2023) The algorithms of deep learning utilize artificial neural networks, which are composed of the input layer, multiple intermediate layers, and the output layer, the input data will be processed and transformed in each of the layers, and the output layer will become the input data in the next input layer, making it a hierarchical representation of data for learning, hence providing the computer to the ability to extract the relevant data from those unlabelled and unstructured data automatically. (Cheng et al., 2024) Convolutional neural networks are a type of deep learning used for analysing visual data such as images and videos. (Cheng et al., 2024; Anwar et al., 2018) It can learn the spatial hierarchies of input data automatically and adaptively through filtering and retrieving the relevant data. The filtering during the training process allows the learning and identification by a network on various patterns, besides, this technique also involves features of reducing the computational complexity. (Cheng et al., 2024; Salimi et al., 2023; Chen et al., 2022)

Physiotherapists' job scope involves performing rehabilitation assessments to design a tailored, suitable treatment plan for the patients who are being referred. However, the initial process was highly dependent on physiotherapists' experiences, and the performance of processes was difficult due to the limited time frame and manpower. Therefore, the usage of AI in rehabilitation was

expanding rapidly to help therapists. (Alsobhi et al., 2022) The application of AI provides the potential to implement a more effective and customized rehabilitation plan. (Nogales et al., 2024) The algorithm process by AI was widely used in healthcare including physiotherapy due to the potential to improve the accuracy and effectiveness of clinical decision-making and treatment outcomes. (Nogales et al., 2024; Alsobhi et al., 2022) In physiotherapy practices, the concept of AI was able to provide training and monitoring to patient through either a virtual (informatics) or physical (robotics) manner. (Alsobhi et al., 2022) A previous study found that the application of AI improves the balance and mobility of Parkinson's Disease due to its high accuracy in providing remote training and detecting the progression of patients. (Wei et al., 2019) Another study meanwhile shown that AI was able to improve the adherence to therapeutics exercise by patients with low back pain and neck pain. (Lo et al., 2018) Another study meanwhile shown the ability of AI to reduce the workload of physiotherapists and simultaneously able to maximize patients' outcomes after total knee replacement surgery. (Correia et al., 2019)

The interpersonal relationship between physiotherapist and their patients is important. This interpersonal relationship was described as a therapeutic alliance, which is the bonding constructed by both physiotherapists and patients. Expectations, opinions, and ideas among each other which develop during the working process, and the bonding felt during the process, were equally important to be established. Among different therapeutic relationships, the therapeutic alliance was the attention of research. In physiotherapy practice, a close therapeutic alliance would enhance the therapeutic outcomes. (Gutiérrez-Sánchez et al., 2021) Therefore, there is increasing interest in studying the therapeutic alliance in physiotherapy in both clinical and literature practice including musculoskeletal physiotherapy. (Gutiérrez-Sánchez et al., 2021; Babatunde et al., 2017) The concept of the therapeutic alliance was first described by Freud's theory of psychoanalysis. The therapeutic alliance describes the positive social relationship between the therapist and the patients, which stresses 3 components: agreement on treatment goals; agreement on tasks, and finally, the development of personal bond. A good and constructive therapeutic alliance has the power to enable patients to first believe, then accept, and ultimately follow the treatment program, therefore leading to more favorable rehabilitation outcomes. (Unsgaard-Tøndel & Søderstrøm, 2021) Hence in a long-term rehabilitation program, a favorable may be the key to enhancing the treatment outcome and lifestyle modifications for patients due to its ability to support the behavioral changes of patients and lead to the empowerment and self-efficiency by them. (Gutiérrez-Sánchez et al., 2021; Taccollini Manzoni et al., 2018; Babatunde et al., 2017) Previous studies had shown the ability of good therapeutic alliance would lead to improvement in modulated pain intensity and muscle pain sensitivity, functioning, and disability experienced by low back pain patients, as well as better adherence of exercise and physical activity in patients with knee pain. (Gutiérrez-Sánchez et al., 2021; Moore et al., 2021; Fuentes et al., 2014; Ferreira et al., 2013)

In psychotherapy, AI was proven to have a positive impact on the therapeutic alliance as shown by Cunningham et al. (2023), hence examining it in physiotherapy based on goal and task components.

Problem statement:

To study the impact of the Artificial Intelligence Vs Physiotherapist Intervention on Therapeutic Alliance Based on Goal Setting and Task Agreement in musculoskeletal conditions.

Objectives of the Research

To study the impact of The Artificial Intelligence Vs Physiotherapist Intervention on Therapeutic Alliance Based on Goal Setting and Task Agreement in musculoskeletal physiotherapy.

To compare the outcome of therapeutic alliance based on goals setting and task-sharing components between AI-planned physiotherapeutic and physiotherapists' planned interventions.

Review Documents:

Stepping into the era of AI, the usage of AI has increased in its concern in multiple sectors, including the healthcare sector. Naqvi et al. (2024) describe that the advancement of AI and machine learning (ML) led to the transformation in healthcare, involving physiotherapists, and the transformation involved education, clinical practice, and research. Large Language Models (LLMs) such as Chat-GPT, can enhance physiotherapy practice in administration, global connection, and treatment planning, despite still having some limitations there. The authors hence encourage the utilization of AI in physiotherapy practice for a better future of the practice. A systematic scoping review done by Morrow et al. (2023) reviewed AI technologies and compassion in healthcare. Through the background of AI technologies affecting the healthcare system in the current world, and the importance of compassion in providing quality healthcare and benefits the society, the authors aimed to find out the correlation in depth for the future shaping of healthcare. Their findings state that AI emphasized awareness, response, behaviour, communication, health coaching, therapeutic interventions, moral development of learning, clinical knowledge and assessment, therapeutic alliance, healthcare information, and advice. This informs the compassion provided by AI through the following elements: Awareness, understanding, connecting, and judgment on what the patients suffer, responding according to alleviate it, and lastly, paying attention to the outcomes and responses. Meanwhile, Hasan et al. (2023) suggest that digital interventions such as AI, the Internet of Things, and machine learning can provide cost-effective, accessible, and preferred interventions that meet the times and resources-constrained populations. Due to the impact of musculoskeletal conditions impacts towards the economy, society, and most importantly one’s life, AI-driven technologies have been suggested as an alternative approach for those populations for improvement of adherence to exercise therapy, which assist in undertaking daily exercise to alleviate the pain. Those interventions were able to develop a strategic plan to manage the discomfort gradually, perform general health check-ups, and offer coping mechanisms, recommendations, peer support, accurate information, and feedback to those populations, with also positive feedback from users.

In clinical settings, the requirement was based on answering the clinical questions and assist in clinical decision-making. Sawamura et al. (2024) had accessed about the accuracy of responses by Chat-GPT to clinical questions and references in physiotherapy. It was evaluated with reference to Physical Therapy Guidelines, published by the Japanese Society of Physical Therapy, and explored the potential of Chat-GPT to be a supporting tool for clinical decision-making in the rehabilitation practice. The authors found that Chat-GPT had a high accuracy in answering the clinical questions despite the low accuracy of referencing, with a high inter-rater agreement. Therefore, they suggested that Chat-GPT can be a useful supporting tool for clinical decision-making. On the other hand, Granviken et al. (2023) invented an AI-based clinical decision support system for supporting both physiotherapists and patients in the decision-making process during the management of musculoskeletal pain conditions. The system utilises the previous success of most similar patients and recommends the management to the new patients. The study found that the tools were usable for

both physiotherapists and patients, whereby it was useful as preparatory tools and exploratory tools, which can enhance the therapeutic relationship. However, it does not appear to affect the clinical decision-making and choice of treatment of physiotherapists for musculoskeletal pain conditions.

The usage and risk of using AI in physiotherapy settings had also been studied. Park et al. (2023) carried out a random controlled trial assessing on long-term effects of deep learning (a branch of AI) digital physical therapy applications on pain, functional limitations, lower extremity weakness, radicular symptoms, range of motion limitation, functional movement, quality of life, cost-effectiveness and satisfaction with comparison to conventional physical therapy. The 4-week study draws the result of the digital-physical therapy applications having a similar effect to conventional physical therapy on structural and functional impairment, activity limitation, and participation restriction. And appears a superior result on clinical outcome measures, lower extremity strength, trunk mobility, activity of daily living, quality of life, and functional movement. Griefahn et al. (2024) on the other hand identified the risk of AI-suggested exercise intervention for patients with musculoskeletal disorders. Different from mobile apps, AI potentially offered a more tailored exercise through processing different pain parameters, comorbidities, and lifestyles to improve the adherence of individuals towards the exercise. However, due to the lack of studies about the risk of AI-recommended exercise interventions, the authors then carried out this study, focusing on strength, mobility, and releasing exercise of patients with musculoskeletal disorders. The risk assessment was identified by physiotherapists and patients' feedback. Their study result did reveal that AI-recommended exercise was almost risk-free for musculoskeletal disorder patients and would be an effective way of planning exercise interventions without risking the patient in pain or discomfort.

The concerns about the patients-therapist relationship, or the therapeutic alliance, had also gain increase in concerns recently in physiotherapy practice. Alodaibi et al. (2021) conducted observational studies on the therapeutic alliance to patient characteristics and functional outcomes of patients with low back pain. Whereby it was suggested that a relevant therapeutic alliance between patients and physiotherapists would impact the outcomes in research, however, the impact in routine physiotherapy had not been quantified. Therefore, using the Work Alliance Inventory- Short Revised (WAI-SR), the authors intend to observe the relationship between therapeutic alliance assessed during physiotherapy of routine care for patients with low back pain and functional outcome after the care is finished. This study suggests the impact of therapeutic alliance on functional outcomes of patients with low back pain, besides, the authors suggest that understanding the therapeutic alliance would enhance the treatment effect and clinical outcomes in physiotherapy routine care. Regarding the choice of assessment tools for the therapeutic alliance in physiotherapy practice, a systematic review by Gutiérrez-Sánchez et al. (2021) about therapeutic alliance instrument measurement in physiotherapy practice. After comparing the Working Alliance and Compliance Scale, Working Alliance Theory of Change Inventory (WOTACI), Working Alliance Inventory (WAI), and Session Rating Scale (SRS), they found that the WAI is the most used and the best outcome measurement to measure the therapeutic alliance in physiotherapy practice. Holmes et al. (2023) studied the correlation of therapeutic alliance, measured using the Work Alliance Inventory, and with patient-reported outcome measures, in the meaning of change in disability and pain experienced in physiotherapy treatment for musculoskeletal conditions. The authors concludes that a higher therapeutic alliance score is more likely to meet the minimal clinical important difference based on patient-reported outcome measures for both disability and pain intensity. Besides, they also found

that patients who scored higher therapeutic alliance scores were improved in changes of outcome measurements. Therefore, they suggest physiotherapists assess the therapeutic alliance and strategically improve the alliance for a better experience for patients in musculoskeletal rehabilitation.

Interestingly, Liu et al. (2022) utilized AI in their therapy, namely chatbots therapy, in comparison to bibliotherapy, which is the therapy of reviewing the literature to understand own conditions, to delivered self-help depression interventions for university students. The study found that chatbot therapy was better in providing treatment for depression and anxiety and provided a better therapeutic alliance measure using the Working Alliance Inventory. This study provided indirect evidence that AI can provide therapeutic alliance. However, to our knowledge, up to the date of this study, no literature studies the potential of AI to provide therapeutic alliance in musculoskeletal physiotherapy practice, given that AI was proven able to deliver useful and risk-free interventions and the importance of therapeutic alliance in physiotherapy practice has also shown its significance. Therefore, this literature review marks a conclusion that there is significance to studying the potential of AI to deliver a therapeutic alliance in musculoskeletal physiotherapy practice.

Methodology

This is a review of randomized controlled trials with single-blinded towards the participants. The sample size calculated using (software). The study population include people visiting (venue) who refer for musculoskeletal physiotherapy management. The experimental group received planned intervention from AI while the control group received the planned intervention by physiotherapists. Both groups received the rationale of treatment and the goals setting from the physiotherapist in charge, but the explanation made by either AI or physiotherapist based on group allocation. The outcome measure based on work alliance inventory (WAI)/ WAI-SF, items based on task items and goals items. The outcome collected after finishing the first course of treatment.

Procedure:

Articles selected with Participants randomly assigned into two groups. Both the groups received a detailed assessment from the physiotherapists in charge. Then the intervention group received the AI-planned physiotherapeutic intervention program, and the control group received planned physiotherapeutic intervention from the physiotherapist. Both the rationale and goals of the intervention are informed to the patients through the physiotherapist. After the treatment, the outcome measure obtained from the participants.

Intervention group:

Articles selected with the group received AI-planned physiotherapy interventions. The intervention obtained from Chat-GPT. The instruction are as: “Planned a physiotherapy intervention/ program using SMART principle for the patient: The patient was having (complaint/ diagnosis) for (duration), having (presentation), with/ without underlying (underlying disease), with/without (comorbidities or related symptom). If there is exercise in it, the command would be implemented: Describe the exercise in details with how to perform and its repetition.

Control group:

The group received the interventions planned by the physiotherapist purely.

Outcome measurement collection:

The outcome measurement collected from the patients after the treatment session. The data collected are analysed using appropriate statistical methods to determine if there were significant differences between the experimental groups in terms of the outcomes measured.

Expected Outcomes

The AI-planned physiotherapeutic interventions provided a therapeutic alliance that was inferior to that of a physiotherapist in terms of goal setting and task sharing.

Study Design and Sampling Method

A randomized controlled trial through convenient sampling method.

Sample size and population

The sample size calculated using (software). The study population include people referred for musculoskeletal physiotherapy management.

Study Area and Period

This study are conducted in SBVU, India & AIMST University, Malaysia.

Selection Criteria

The target population are meticulously chosen based on specific inclusion and exclusion criteria. These criteria are essential for identifying population that is most appropriate for the research, ensuring they match the scientific objectives of the study. This careful selection is vital for reducing potential biases, and enhancing the study's relevance and practicality. Establishing clear and relevant inclusion criteria is key to ensuring the sample population is uniform, which, in turn, supports the accuracy and reliability of the research outcomes.

Inclusion Criteria

People referred for musculoskeletal physiotherapy management only

Exclusion criteria

People referred for any other department rather than musculoskeletal physiotherapy management.

Data entry and analysis

The data analysis is performed by using SPSS. Descriptive statistic is used for data analysis which will focus through table and chart. Tabulation and computation of frequencies and percentages are calculated on selected variables.

Results

The system utilises the previous success of most similar patients and recommends the management to the new patients. The tools were usable for both physiotherapists and patients, whereby it is useful as preparatory tools and exploratory tools, which can enhance the therapeutic relationship. However, it does not appear to affect the clinical decision-making and choice of treatment of physiotherapists for musculoskeletal pain conditions.

Discussion

The usage and risk of using AI in physiotherapy settings had also been studied. Park et al. (2023) carried out a random controlled trial assessing on long-term effects of deep learning (a branch of AI)

digital physical therapy applications on pain, functional limitations, lower extremity weakness, radicular symptoms, range of motion limitation, functional movement, quality of life, cost-effectiveness and satisfaction with comparison to conventional physical therapy. The 4-week study draws the result of the digital-physical therapy applications having a similar effect to conventional physical therapy on structural and functional impairment, activity limitation, participation restriction and appears a superior result on clinical outcome measures, lower extremity strength and trunk mobility, activity of daily living, quality of life, and functional movement.

Conclusion

A higher therapeutic alliance score is more likely to meet the minimal clinical important difference based on patient-reported outcome measures for both disability and pain intensity. Besides, patients who scored higher therapeutic alliance scores will improve in changes of outcome measurements. Therefore, physiotherapists assess the therapeutic alliance and strategically improve the alliance for a better experience for patients in musculoskeletal rehabilitation.

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