

Application of modular ortho-massage system in early post-operative therapy

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Received: 2025-06-05

Accepted: 2025-07-05

DOI: <https://doi.org/10.5281/zenodo.17027581>

Abstract. *The article focuses on examining the effectiveness of using a modular ortho-massage system as part of early postoperative therapy to improve rehabilitation outcomes and clinical results. The aim of the study is to justify the use of a modular ortho-massage system as a component of early postoperative therapy for enhancing clinical outcomes and accelerating patient recovery. The study employed general scientific methods of cognition, including analysis, synthesis, comparison, induction, deduction, systematization, and generalization. The findings demonstrate that implementing ortho-massage therapy during the early postoperative period is a relevant direction in modern medical rehabilitation, grounded in the principles of a multidisciplinary approach and personalized medicine. Massage therapy contributes to reducing pain, relieving muscle tension, and stabilizing patients' psycho-emotional condition, which collectively promotes faster healing after surgery and supports an earlier return to functional activity. The inclusion of massage in a comprehensive mobilization system, which also involves physical activity, electrical stimulation, and muscle relaxation, produces a pronounced synergistic effect and decreases the likelihood of complications. The study shows that within 7 to 21 days after surgery, patients receiving massage therapy exhibit positive progress. The effectiveness of autonomous mechanical systems, particularly TISA Neuro-Ortho Therapy and exoskeletal massage modules, was also explored, revealing their beneficial impact even for patients with limited access to standard physical rehabilitation. The practical value of this research lies in the potential integration of modular ortho-massage systems as an effective rehabilitation tool in clinical postoperative care.*

Keywords: *ortho-massage therapy, postoperative rehabilitation, modular systems, physical therapy, personalized medicine.*

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Introduction

Modern postoperative rehabilitation increasingly relies on multicomponent approaches that combine pharmacological, physical, and psycho-emotional methods to optimize patient recovery after surgical interventions. One of the effective tools within this framework is massage therapy, which, due to its analgesic, vasoactive, and sedative properties, helps reduce pain, improve blood circulation, decrease muscle tension, and stabilize neurovegetative regulation. Integrating massage into early mobilization protocols helps prevent complications such as muscle atrophy, contractures, and prolonged hypodynamia, while also improving patients' quality of life during hospitalization and after discharge.

In the context of rapid medical technology development, there is growing interest in automated modular ortho-massage systems that enable standardized and controlled therapeutic procedures. These systems provide greater precision, reproducibility, and effectiveness compared to traditional manual techniques. Moreover, their autonomy and suitability for use outside clinical settings expand access to massage therapy and create opportunities for integration into personalized rehabilitation protocols. This highlights the relevance of studying the role of massage, particularly modular ortho-massage systems, as an essential component of early postoperative therapy.

The issue of applying modular ortho-massage systems in early postoperative therapy is well covered in international scientific literature. Notable contributions include the work of R. Chen et al. [1], who conducted a systematic review and meta-analysis on the effectiveness of massage following total knee arthroplasty. Their findings emphasize the role of massage in reducing pain and improving mobility in the early stages of recovery. M. Eghbali et al. [2] confirm the efficacy of massage in alleviating pain intensity in orthopedic patients, highlighting its clinical advantages. E. Kasim et al. [3] examined the use of foot massage in patients after cesarean section, indicating the method's potential beyond orthopedics and within general postoperative therapy. Research by S. Kim et al. [4] focuses on mechanical massage and its positive impact on postoperative recovery, findings that are particularly relevant in the context of modular systems automating therapeutic procedures. Equally important is the work of S. Komarova et al. [5], who developed a modular exoskeletal system for hand rehabilitation, illustrating a technological approach to physical therapy. X. Li et al. [6] conducted a large-scale analysis of trends in massage application within perioperative medicine, further confirming the growing scientific interest in this area. C. Liu et al. [7] presented a meta-analysis summarizing the effects of massage on postoperative pain across various clinical settings. A. Mph et al. [8] conducted a randomized study supporting the use of massage as an adjunct therapy in treating acute postoperative pain. Finally, E. Price [9] highlighted the critical role of massage therapy in early recovery following mastectomy, and R. Putri et al. [10] explored early mobilization after orthopedic surgeries in a broader context.

Despite the abundance of literature on this topic, there is a lack of systematized material related to the subject of this study. Therefore, through the use of various scientific methods, relevant information was analyzed, grouped, and organized in accordance with the research focus.

The aim of the article is to justify the use of a modular ortho-massage system as a component of early postoperative therapy for enhancing clinical outcomes and accelerating patient recovery. In order to achieve this aim, the following tasks were identified: analyze the importance of ortho-massage therapy in the early stages of recovery and describe the main phases and types of early mobilization after surgery; determine the advantages and specific features of using modular ortho-massage systems in comparison with traditional manual techniques; outline promising directions for further development of massage therapy in the context of technological integration, standardization, and personalization of the rehabilitation process.

Research Results

Massage therapy in the early postoperative period is increasingly recognized as an integral part of modern rehabilitation, especially following surgical interventions. Its value lies not only in reducing pain and muscle tension but also in stabilizing the psycho-emotional state of patients, which is critical for effective healing. As noted by Price E. [9], combining massage with physical therapy produces a synergistic effect, accelerating functional recovery and improving overall well-being. Its use makes it possible to reduce pain intensity without pharmacological load, which is particularly relevant during the early rehabilitation phase, when patients face limited mobility and a high risk of developing motor complications [2].

It is well known that even short massage sessions lasting up to 20 minutes can produce clinically significant pain relief. This primary effect is explained by the activation of the parasympathetic nervous system, stimulation of the endorphin response, and reduction in muscle tension, which together lower the subjective perception of discomfort. Massage does not replace pharmacological treatment but complements it, enhancing the analgesic effect without adding risk [2].

Particular attention should be given to light, superficial massage (stroking), which is recommended in clinical practice due to its gentleness, lack of side effects, accessibility, and ease of application. This manual technique is especially suitable for patients experiencing moderate or severe pain, as well as in short-term rehabilitation programs constrained by inpatient stays [2].

Applying such techniques in the early postoperative phase not only reduces pain severity but also helps prevent motor dysfunctions and secondary complications. Researchers also emphasize the importance of educating healthcare professionals, patients, and their family members in this method, allowing therapy to continue after discharge. This, in turn, can potentially reduce the overall burden on the healthcare system and improve patients' quality of life [2].

According to Liu C. et al. [7], a meta-analysis of 33 randomized controlled trials confirmed that massage, regardless of session duration, technique type, or dosage, significantly reduced pain. The most pronounced analgesic effects were observed in adult patients after cesarean section and cardiac surgeries, compared to orthopedic operations [7].

Local massage, particularly in the foot area, positively influences not only localized pain relief but also the patient's overall physiological condition. It enhances peripheral circulation, activates receptor zones, promotes relaxation, and reduces anxiety. Collectively, this improves neurovegetative regulation and psycho-emotional comfort. Such effects increase the body's overall adaptation to postoperative stress and may support faster healing. As demonstrated in the study by Kasim E., Ibrahim W., Limbong M., and Hafida E., even brief local procedures, when performed regularly and with the support of others, produce a tangible systemic therapeutic effect [3].

In postoperative rehabilitation after orthopedic surgeries, timely implementation of early mobilization is a crucial factor for successful recovery. This approach helps prevent complications, accelerates the return of functional activity, shortens hospital stays, and improves patients' quality of life. According to a review by Putri R. et al. [10], there are five main types of interventions that are effective within early mobilization after orthopedic operations. A brief overview of these is provided in the table below [10].

Table 1 – Main types of early mobilization after orthopedic surgeries

Type of intervention	Primary action and therapeutic effect
1. Motor interventions	Include active and passive movements aimed at increasing joint range of motion, improving blood circulation, and preventing contractures.
2. Progressive muscle relaxation (PMR)	A method of controlled muscle tension and relaxation that reduces pain and anxiety, strengthens muscles, and decreases kinesiophobia.
3. Weight-bearing interventions	Partial or full body weight is transferred onto the operated limb, helping to reduce stiffness, alleviate pain, and stimulate stability.
4. Body positioning	Therapeutic changes in body position (e.g., limb elevation) that help reduce blood loss, improve venous return, and enhance mobility.
5. Neuromuscular electrical stimulation (NMES)	The use of electrical impulses to activate muscles in order to prevent atrophy, enhance contractile ability, and accelerate recovery.

Notes: systematized by the author based on source [10]

The integration of these five types of early mobilization into rehabilitation protocols enables improved clinical outcomes in patients after orthopedic surgeries. Motor interventions and progressive muscle relaxation proved especially effective, contributing to faster restoration of range of motion within just six weeks post-surgery. These findings support the need for a multidisciplinary approach and the implementation of personalized technological solutions, including ortho-massage systems, to enhance the effects of early mobilization.

Massage promotes better circulation, tissue relaxation, and reduced anxiety, which are particularly important in the later stages of postoperative adaptation. As Chen et al. [1] point out, these effects make the long-term integration of massage therapy into post-surgical care a justified and effective approach to recovery, improving patients' quality of life and reducing the need for pharmacological interventions. This effect is not only immediate but also cumulative – with regular massage sessions, pain gradually decreases day by day, enabling patients to transition to active rehabilitation sooner without requiring higher doses of opioid analgesics [8].

In addition to its analgesic effect, massage indirectly contributes to improved functional status of the respiratory system – by relieving pain, it increases tolerance for breathing exercises, which is critical during the early phase of postoperative recovery. At the same time, massage therapy is not associated with side effects or complications, emphasizing its safety as an adjunct treatment method [8].

Thus, massage serves as an effective non-pharmacological component of postoperative therapy, combining physiological impact with psycho-emotional support to accelerate recovery and reduce the overall therapeutic burden [8].

A particularly important factor is the ability to integrate massage into a technologically controlled modular ortho-massage system, which allows for a standardized, reproducible, and individualized approach to therapy. Unlike manual massage, which varies methodologically and depends on practitioner qualifications, the modular system enables precise control over intensity, duration, and frequency, minimizing subjective variability and enhancing clinical consistency. As a result, ortho-massage therapy can serve as a valuable complement to

conventional treatment, optimizing postoperative recovery through the combined effects of mechanical stimulation, psychophysiological relaxation, reduced anxiety, and muscle tension.

These effects are especially significant in preventing secondary complications such as reduced joint mobility, muscle atrophy, and prolonged immobility. Evidence from systematic reviews shows that integrating massage therapy into comprehensive rehabilitation not only accelerates physical recovery but also reduces overall treatment costs by shortening hospital stays. Based on this data, the modular ortho-massage system may represent an innovative and well-founded solution for improving the effectiveness of early postoperative therapy.

Table 2 – Recovery indicators resulting from the use of modular ortho-massage therapy

Indicator	Time after surgery	Description of the effect of modular ortho-massage therapy
Reduction of acute postoperative pain	7 days	Patients experienced decreased initial pain sensitivity without the need for additional analgesics, allowing for a quicker transition to active rehabilitation.
Reduction of residual pain in the subacute phase	14 days	Massage helped alleviate pain associated with swelling, muscle tension, and surgical trauma.
Relief during movement and reduced discomfort under load	21 days	Pain during active movement or attempts to walk independently was significantly reduced, indicating a cumulative effect of ortho-massage.
Improved range of active motion in the knee joint	7 days	Stimulation of soft tissues and pain reduction led to early improvements in knee flexion and extension.
Increased stability and control of joint movements	14 days	Massage activated stabilizing muscles around the knee, providing greater confidence during standing and walking.
Shortened hospital stay	Postoperative period	Patients receiving ortho-massage therapy required fewer days under medical supervision due to accelerated recovery of basic functions.

Notes: systematized by the author based on source [1,5,8]

Modular ortho-massage therapy is an effective and promising tool in postoperative rehabilitation, contributing to pain reduction, improved mobility, and shorter hospitalization periods. One example is a portable hand exoskeleton described in the study by Komarova S., Lin T.-C., Ingaramo M., and Molteni F., which supports finger function recovery after injury through controlled mechanical stimulation. This approach demonstrates the effectiveness of integrating massage action into an autonomous modular platform that patients can use independently at home [5].

The study by Kim S. et al. [4] examines the efficacy of mechanical massage in patients with knee swelling after total knee arthroplasty (TKA). A notable feature of the study is the use of Endermologie® – a non-invasive mechanical massage technique – as the sole treatment method without additional physiotherapeutic procedures, allowing for an objective assessment of its effect on postoperative swelling dynamics.

Researchers used ultrasound to assess soft tissue volume and bioelectrical impedance spectroscopy to quantitatively analyze tissue changes around the knee. The findings showed that massage helped reduce extracellular fluid, decrease limb circumference, and improve active knee flexion in the early postoperative period. This, in turn, may positively influence rehabilitation outcomes and patients' functional independence.

The authors emphasize that although swelling after TKA is an expected response, its impact on pain, mobility, and delays in functional recovery can be significant. In this context, mechanical massage using the Endermologie® technique proved to be a promising method for managing swelling, particularly in patients unable to undergo intensive physical therapy.

Today, a wide range of ortho-massage systems exist, combining compression, mechanical stimulation, and personalized adjustments. One especially noteworthy example is the TISA Neuro-Ortho Therapy system – an innovative rehabilitation complex developed by Ukrainian researcher Ihor Sarnov. This system integrates seamless compression textiles manufactured using advanced 3D-knitting technology with precisely calibrated massage tools (“Tetrakom,” “Octopus,” “Turtle,” “Star”) that provide multi-zonal stimulation of the skin, subcutaneous tissue, muscles, and fasciae. The textile components incorporate natural fibers such as cotton and wool, which enhance comfort, thermoregulation, and biocompatibility. The system also includes support elements, such as cooling applicators, for localized anti-inflammatory effects.

This research illustrates the potential of using autonomous mechanical massage systems in clinical practice, which is particularly valuable for developing effective, standardized rehabilitation protocols following orthopedic interventions.

According to analytical data presented by Li X. et al. [6], future development of massage therapy in perioperative medicine offers several promising directions that open new opportunities for both fundamental research and clinical implementation.

First, growing interest is expected in acupoint massage as the most promising non-pharmacological technique. Future research is likely to focus on elucidating the neurophysiological mechanisms of its action, particularly its effects on nociceptive modulation, neurotransmitter systems, parasympathetic regulation, and neuroendocrine responses. This will not only confirm the clinical efficacy of massage but also strengthen its scientific grounding within evidence-based medicine.

The second major direction involves the standardization of massage therapy protocols based on the type of surgery. In the context of TKA, cardiac surgery, oncology, and gynecology, specific algorithms will be developed regarding duration, frequency, target areas, and manipulation types. This will support broader integration of massage into clinical perioperative rehabilitation guidelines.

Further digitization and technological enhancement of massage stimulation methods are also expected – particularly through automated devices replicating acupuncture or lymphatic drainage techniques. This will expand access to therapy and facilitate its application in outpatient and home-based settings.

One of the promising directions in the development of massage therapy, particularly within the framework of neuro-orthotherapy, is the use of temperature-controlled modules – both cooling and warming. The first category includes localized cooling systems based on the use of specialized materials that are stored under refrigerated conditions and applied in clinical settings, sports medicine, automobiles (via first-aid kits), sports facilities, and rehabilitation rooms. These cooling agents provide a rapid anti-inflammatory and analgesic effect, especially during the acute phase following surgery or injury. A notable example involves chemical cold packs, which rely not on gel but on a reaction between salt (typically ammonium nitrate) and water. When the internal compartment is ruptured by a light shake or squeeze, the components mix, triggering an endothermic reaction that rapidly reduces the temperature to approximately 0 °C or even as low as –2 °C. These instant cold packs do not require pre-freezing, making them highly effective and portable tools for emergency pain relief and hematoma reduction. For these reasons, they are widely applied across sports, first-response scenarios, and routine rehabilitation practice.

The second direction involves natural warming technologies, utilizing natural fibers such as wool, cotton, and alpaca wool to produce specialized belts and compression textile

products. These materials possess unique thermoregulatory properties, delivering gentle deep heat that enhances circulation, promotes muscle relaxation, and improves tissue tone. Such warming products are used both in the recovery phase following cooling and in conditions of chronic muscle tension or vascular disorders. These items have been successfully present on the U.S. market for over 15 years, are manufactured in Ukraine, and are exported as high-quality rehabilitation textiles.

Therefore, the advancement of massage therapy in perioperative care is moving toward scientific validation, technological modernization, protocol development, and global implementation – and has all the prerequisites to become an integrated component of personalized medicine in the future.

Conclusions

The use of ortho-massage therapy in the early postoperative period is an important area of modern rehabilitation based on the principles of a multidisciplinary approach and personalized medicine. Massage contributes to pain relief, reduced muscle tension, and improved psycho-emotional well-being, all of which accelerate healing and support the return to functional activity. Integrating massage therapy into early mobilization – alongside motor interventions, progressive muscle relaxation, electrical stimulation, and other techniques – creates a synergistic effect and lowers the risk of complications. Clinical data show that within the first 7–21 days after surgery, massage has a significant positive impact on recovery dynamics.

The integration of modular ortho-massage systems into postoperative therapy opens new opportunities for standardization, objectification, and personalization of therapeutic interventions. With precisely calibrated stimulation parameters (intensity, duration, frequency), such systems minimize human factor variability, increase reproducibility of outcomes, and enhance procedural safety. Examples of implementing mechanical massage platforms such as TISA Neuro-Ortho Therapy or exoskeletal massage modules demonstrate the effectiveness of autonomous therapy, particularly in patients with limited access to conventional physical rehabilitation.

The further development of massage therapy in the context of perioperative care involves its scientific validation, technical advancement, and digital transformation. Research focused on the neurophysiological basis of acupressure and acupuncture massage, the creation of standardized protocols based on surgery type, and the development of automated technologies suitable for self-use all contribute to embedding massage therapy into personalized recovery models aligned with the standards of evidence-based medicine in the 21st century.

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