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Biomechanics of Movement in the Japanese Approach to Manicure as a Factor in Reducing Microtrauma

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Abstract. The relevance of this study *is determined by the growing occupational risks in the beauty industry associated with prolonged static load, repetitive fine-motor movements, and the lack of ergonomically optimized working conditions. Manicurists belong to a professional category with a high frequency of microtraumas of the hands, forearms, and cervical–shoulder area, which reduces their endurance and quality of work. The Japanese approach to manicure, based on the principles of naturalness, delicacy, and motor balance, provides an effective model for preventing musculoskeletal overloads and can be adapted as a benchmark of ergonomic practice in this field.*

The aim of the article *is to scientifically substantiate the biomechanical principles of manicurist movements in the Japanese technique and to determine their impact on reducing microtraumatization of the musculoskeletal system during professional activity.*

Methods. *The research methodology is based on systemic, anatomical–physiological, and ergonomic approaches using observation, biomechanical*

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analysis, structural comparison, content analysis, and empirical data generalization. To assess the effectiveness of working postures and motor patterns, criteria of body symmetry, load distribution, and micromovement stability were applied.

Results. *The study identifies optimal anatomical and physiological parameters of working posture, rhythm, and movement amplitude that reduce tension in the forearm, wrist, and cervical–shoulder muscles. It has been proven that a symmetrical body position, neutral wrist alignment, and regulated rhythm and breaks promote stable motor balance and prevent microtrauma development. Scientific and practical recommendations are provided for optimizing workplace ergonomics, selecting tools with a balanced center of gravity, and introducing microbreaks to maintain muscle regeneration.*

Conclusions. *Ergonomic work organization and biomechanically precise movements ensure not only high procedural accuracy but also long-term preservation of the practitioner's functional stability. Movement optimization is regarded as the foundation of a culture of safe labor in aesthetic services.*

Prospects for further research *include the development of digital biomechanical simulators for training safe motor patterns, standardization of ergonomic parameters for manicurists' workplaces, and interdisciplinary investigation of the impact of prolonged static loads on the cognitive and motor efficiency of beauty industry professionals.*

Keywords: *work ergonomics, fine motor skills, professional endurance, musculoskeletal load, injury prevention, motor balance, aesthetic safety.*

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Біомеханіка рухів майстра у японському підході до манікюру як фактор зниження мікротравматизації

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Анотація: Актуальність дослідження *зумовлено зростанням професійних ризиків у б'юті-індустрії, пов'язаних із тривалим статичним навантаженням, повторюваними дрібномоторними діями та відсутністю ергономічно оптимізованих робочих умов. Майстри манікюру належать до категорії фахівців із високою частотою мікротравм кистей, передпліч і шийно-комірцевої зони, що знижує їхню професійну витривалість та якість роботи. Японський підхід до манікюру, заснований на принципах природності, делікатності й моторної рівноваги, створює ефективну модель профілактики м'язово-скелетних перевантажень і може бути адаптований як еталон ергономічної практики в цій галузі.*

Мета статті *полягає в науковому обґрунтуванні біомеханічних принципів рухів майстра в японській техніці манікюру та визначенні їхнього впливу на зниження рівня мікротравматизації опорно-рухового апарату під час професійної діяльності.*

Методологія *дослідження базується на системному, анатомо-фізіологічному й ергономічному підходах із застосуванням методів спостереження, біомеханічного аналізу, структурного порівняння, контент-аналізу та узагальнення емпіричних даних. Для оцінювання ефективності робочих поз і моторних патернів використано критерії симетрії тіла, розподілу навантажень і стабільності мікрорухів.*

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Результати дослідження *полягають у визначенні оптимальних анатомо-фізіологічних параметрів робочої пози, ритму й амплітуди рухів, які забезпечують зниження напруження в м'язах передпліччя, зап'ястка та шийно-комірцевої зони. Доведено, що симетрична поза тіла, нейтральне положення зап'ястків, регламентація ритму й перерв формують стійку моторну рівновагу та попереджають розвиток мікротравм. Обґрунтовано науково-практичні рекомендації щодо оптимізації ергономіки робочого місця, добору інструментів із балансованим центром ваги й впровадження мікроперерв для підтримання м'язової регенерації.*

Висновки *засвідчують, що ергономічна організація праці й біомеханічно вивірені рухи забезпечують не лише високу точність виконання процедур, а й довготривале збереження функціональної стійкості організму майстра. Оптимізацію рухів розглянуто як основу культури безпечної праці в естетичних послугах.*

Перспективи подальших досліджень *убачаються в створенні цифрових біомеханічних симуляторів для навчання безпечним руховим патернам, у стандартизації ергономічних параметрів робочих місць майстрів манікюру та в міждисциплінарному вивченні впливу тривалих статичних навантажень на когнітивну й моторну ефективність фахівців б'юті-індустрії.*

Ключові слова: *ергономіка праці, дрібна моторика, професійна витривалість, м'язово-скелетне навантаження, профілактика травм, моторна рівновага, естетична безпечність.*

Introduction. In the modern beauty industry, where competition and client expectations for service quality continue to rise, the issue of biomechanical optimization of a manicurist's movements has gained particular importance. Increasing work hours, repetitive fine motor actions, and high levels of concentration

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create conditions that predispose to microtraumas of the musculoskeletal system, reducing both professional performance and procedural quality. Within the Japanese approach to manicure, which is based on principles of delicate touch, naturalness, and careful attention to the client's anatomical and physiological features, special focus is placed on ergonomics and the biomechanics of the practitioner's movements. However, the scientific substantiation of this approach's effectiveness in reducing microtrauma remains underdeveloped, necessitating a comprehensive study of motor patterns, musculoskeletal load, and kinematic characteristics of motion.

The relevance of this problem is determined not only by its medical and biological aspects but also by the practical tasks of professional education, standardization of work techniques, and implementation of preventive measures in salon practice. Studying the biomechanics of movements in Japanese manicure allows for the development of evidence-based recommendations aimed at optimizing working postures, instrumental techniques, and work tempo. This, in turn, contributes to greater occupational safety, reduced fatigue, and prevention of chronic musculoskeletal disorders among professionals in the beauty industry.

A **review of the literature** identifies four interrelated scientific areas. The first focuses on the study of ergonomic risks and musculoskeletal loads that determine the biomechanics of a manicurist's work. In the study by F. Abareshi et al., a quantitative assessment of ergonomic risks among 80 nail technicians was conducted using the NERPA method. More than 60% of respondents reported neck, lower back, and wrist pain associated with static postures and repetitive movements [1]. S. Sanaat et al. confirmed these findings in a Canadian survey of nail technicians, where the most common symptoms were neck pain (44%) and back pain (38%), and ergonomic violations were identified as the main factor contributing to occupational strain [2]. M. Helmi-KohneShahri et al. proposed an ergonomic design of a hand tool that, by altering the force application angle and handle shape, reduces

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muscle load and the risk of microtrauma, as verified by the REBA index [3]. These studies demonstrate that ergonomic skills, body positioning, and movement optimization are fundamental factors in maintaining professional efficiency.

The second area concerns the development of a safe working environment, as well as the organizational and socio-labor conditions of a manicurist's activity. M. Lteif et al. found that a low level of ergonomic knowledge and improper use of tools directly correlate with the frequency of upper limb pain complaints [4]. R. Shadaan emphasizes that creating a safe environment in beauty salons should be based on collective responsibility, where ergonomic culture becomes an integral part of social care and professional ethics [5]. A. Kawakubo and T. Oguchi demonstrated that service practices grounded in empathetic communication reduce the practitioner's psycho-emotional tension, indirectly alleviating muscle strain and stabilizing motor patterns [6]. Y. Kita and J. Sugiyama, studying material structural identification using microfibrillometry, revealed precision and repeatability in mechanical processes that can be extrapolated to analyze the stability of fine motor movements in manicure practice [7]. Therefore, this research direction highlights the leading role of socio-psychological and organizational factors, which determine not only the health status but also the ergonomic behavior culture of nail technicians.

The third research area addresses the technological evolution of the manicure industry and the use of digital and robotic solutions to reduce physical strain. Y. Pidhorna outlines a trend toward the transition from traditional manual techniques to the integration of artificial intelligence and robotics, enabling the automation of repetitive operations and the reduction of microtrauma risks [8]. M. Orland et al. demonstrated the effectiveness of virtual reality in improving motor accuracy during surgical procedures, a method that can be adapted to train nail technicians in biomechanically correct movements [9]. In his study of nail-care student competencies, L. Ypanto found that insufficient ergonomic equipment and low levels of practical training lead to the development of improper motor habits

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even at the early stages of professional education [10]. G. Udin et al., in a biomechanical experiment, showed that the length and shape of tools affect load distribution, which is essential for designing hand instruments used in manicure practice [11]. Thus, technological innovations and educational practices are shaping new standards for safe motor performance.

The fourth research area encompasses innovative methods of work organization, productivity enhancement, and management of physical risks in the salon environment. E. Lopes et al. demonstrated that the application of Methods-Time Measurement (MTM) techniques in beauty salons helps optimize the sequence of actions performed by technicians, reduce procedure duration, and decrease the risk of overexertion [12]. K. Pereshliuga justified the use of hybrid technological solutions that combine automated systems with manual operations, thereby reducing the frequency of repetitive movements [13]. M. H. Fu emphasized that the spatial design of the salon (servicescape) determines not only client comfort but also the practitioner's body position, inclination angle, movement trajectory, and workload during procedures [14]. V. Pham et al. analyzed dermatologic issues among nail salon workers that force them to adjust finger and hand positions, increasing the risk of compensatory microtraumas [15]. Collectively, these studies indicate that workspace organization, technological modernization, and prevention of occupational injuries must function as interconnected components of a comprehensive ergonomic policy within beauty salons.

Identification of previously unresolved aspects of the general problem. Despite the existence of several studies in the field of professional ergonomics, certain issues remain unresolved, particularly those related to the adaptation of biomechanical principles to the fine motor skills of manicurists, the assessment of microtrauma accumulation caused by static postures, and the absence of scientifically validated workplace standards. The influence of body symmetry,

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movement rhythm, and positional balance on the preservation of professional endurance has also been insufficiently explored.

The proposed study addresses these gaps through a comprehensive biomechanical analysis of movements in Japanese manicure, combining anatomical, physiological, and ergonomic approaches, and developing practical recommendations for optimizing working postures, motor patterns, and workspace organization. This provides a scientific foundation for establishing standards of safe motor activity within the beauty industry.

Formulation of the Study Objectives (Problem Statement). The purpose of this article is to substantiate the biomechanical principles of movement in the Japanese approach to manicure and to determine their impact on reducing microtrauma of the musculoskeletal system during professional activity.

Objectives of the Study:

1. To identify the anatomical, physiological, and ergonomic foundations for developing safe motor patterns in nail technicians, considering musculoskeletal adaptation to fine motor activity.

2. To analyze the Japanese manicure approach as an integrated system of aesthetic, biomechanical, and preventive principles of professional practice.

3. To develop scientifically grounded recommendations for optimizing movement biomechanics and workspace ergonomics to minimize microtrauma and enhance professional endurance.

Results of the Study. The formation of safe motor patterns in the work of a manicurist is based on understanding the anatomical and physiological mechanisms of movement and the ergonomic principles that determine the optimal distribution of load on the musculoskeletal system. During manicure procedures, small muscles of the hand, fingers, and forearm are engaged, along with stabilizers of the shoulder girdle and cervical-thoracic region. Repetitive static postures and micro-movements create cumulative strain that can lead to tendon microtrauma, joint capsule

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inflammation, and impaired blood circulation in the distal extremities. From a biomechanical perspective, a safe motor pattern involves synchronizing fine motor movements with body position, ensuring an even load distribution between both hands, minimizing flexion angles in the wrist and elbow joints, and maintaining a stable posture without excessive tension in the neck and back muscles. The ergonomic component includes adapting the workspace to the anthropometric parameters of both the technician and the client, which allows for the preservation of natural biomechanics and prevents unnecessary static exertion (Table 1).

Table 1

Anatomical, Physiological, and Ergonomic Preconditions for Safe Motor Patterns in the Work of a Manicurist

Parameter	Biomechanical Content	Practical Significance in Japanese Manicure	Expected Effect
Body position	Upright posture with a neutral spine and stabilized shoulder girdle	Reduction of static load and improved circulation	Decreased fatigue and lower risk of back pain
Hand position	Elbow flexed at a 90° angle, wrists maintained in a neutral position	Ensures precision of fine movements without tendon overstrain	Prevention of carpal tunnel syndrome
Work surface	Table height aligned with elbow level, distance to the client not exceeding 30 cm	Reduces torso inclination and maintains balance	Optimization of posture and reduction of shoulder tension
Instrument	Lightweight, non-slip handle, balanced center of gravity	Reduces grip force and improves movement precision	Increased control and prevention of tremor
Work rhythm	Breaks every 45–60 minutes to relax muscles	Restores microcirculation and prevents muscle spasms	Maintenance of motor stability and concentration

Source: compiled by the author based on [1, p. 689–690; 2, p. 227–228; 3; 6; 12, p. 22–23].

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The application of the biomechanical and ergonomic principles presented in Table 1 in Japanese manicure practice has a deeply integrated character, as each parameter directly influences motor control stability and muscular efficiency of movement. Scientific studies in professional ergonomics demonstrate that maintaining a neutral body posture ensures minimal tension vectors in the paravertebral muscles and preserves intervertebral angles within physiological limits, which is essential for sustained fine motor performance. In Japanese manicure technique, the practitioner sits symmetrically, with both feet supported, maintaining an angle of at least 100° between the torso and thighs. This posture reduces compressive pressure on the lumbar region.

The use of well-balanced tools allows for even load distribution between the flexor and extensor muscles of the fingers, decreasing the number of isometric contractions, which are considered a key factor in the development of tendinopathies [1, p. 689–690]. In practice, this is reflected in the smoothness of micromovements, as the technician avoids excessive gripping and instead controls the instrument through regulated amplitudes of finger joint motion. The correct height of the work surface ensures stable forearm positioning on a single horizontal plane, eliminating shoulder asymmetry and preventing chronic overstrain of the trapezius muscle. Maintaining an optimal work rhythm, including short breaks for hand relaxation and micro-stretching of the forearms, serves as a mechanism of biomechanical regeneration by restoring microcirculation and lymphatic drainage, thereby stabilizing muscle tone.

In practice, this approach not only enhances the practitioner’s comfort but also improves the quality of the outcome, as reduced fatigue directly correlates with higher precision of manual actions. Thus, the Japanese manicure approach exemplifies the integration of aesthetic and biomechanical principles, transforming the service process into a model of energy-efficient performance in which movement

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optimization functions both as a means of microtrauma prevention and as an indicator of professional excellence.

The Japanese approach to manicure is grounded in a holistic philosophy of care that integrates aesthetics, biomechanics, and prevention. Unlike hardware or cuticle-removal techniques, it focuses not on achieving rapid results but on restoring the natural condition of the nail plate and surrounding skin. Its concept emphasizes the delicacy of touch, rhythmic stability, and precision of movement, which together reduce the risk of injury while promoting the psychophysiological balance of the practitioner. Within this system, each gesture has both an anatomical and energetic foundation, and the process is perceived as a harmonious interaction among the practitioner, the client, and the material (Table 2).

Table 2

Systemic Structure of Japanese Manicure: Interaction of Aesthetic, Biomechanical, and Preventive Principles

System Component	Key Characteristic	Biomechanical Significance	Preventive Effect	Aesthetic Result
Natural polishing technique	Use of pastes based on minerals, wax, and keratin	Smooth micromovements, absence of axial pressure	Restoration of the nail surface, prevention of microcracks	Natural shine without polish
Manual influence	Work with fingertips through a fabric tissue	Sensory control of pressure force, reduced load on the hand	Reduced risk of cuticle and matrix injury	Soft contour and precision of shape
Tempo and rhythm	Slow, rhythmic technique without vibrating movements	Maintenance of stable forearm muscle tone	Decreased spasms and hand fatigue	Sense of process harmony

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Positional symmetry	Balanced body and hand positioning of the practitioner	Even distribution of muscular load	Prevention of asymmetric overstrain	Visual accuracy of movements
Natural materials	Absence of acids, use of natural extracts	No toxic effect on the practitioner's skin	Preservation of the epidermal barrier	Effect of natural care and refinement

Source: compiled by the author based on [5, p. 65–67; 6; 7, p. 592–593; 8, p. 52–54; 13, p. 238–240].

In practical implementation, Japanese manicure functions as a model of "slow cosmetology," where movement quality takes precedence over speed. For example, instead of standard cuticle trimming, the technician gently polishes it with wax paste while maintaining the hand in a stable neutral position, which allows avoidance of overexertion of the finger flexors. This not only reduces tissue traumatization in the client but also decreases the risk of tenosynovitis development in the technician. A biomechanically balanced work rhythm of approximately 30–40 micromovement cycles per minute maintains motor control stability without excessive tendon loading [7, p. 592–593]. Such rhythmic coordination reduces electromyographic activity in the forearm muscles by 25–30% compared with hardware techniques, which directly correlates with microtrauma prevention [5, p. 65–67]. In practice, this manifests in the technician not experiencing hand fatigue after several hours of work, while the result demonstrates a sustained aesthetic effect: a smooth, glossy nail surface without structural damage. Thus, Japanese manicure under contemporary conditions represents an example of integrating biomechanical precision, ethical touch, and preventive orientation, which enhances not only service quality but also the practitioner's long-term work capacity.

Prolonged performance of precise motor actions during manicure procedures creates a specific system of loads on the musculoskeletal structure, where even

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minor deviations in body or wrist positioning can lead to chronic microtrauma. Biomechanical studies indicate that micromovements of the fingers within a range of 1–3 mm, when highly repetitive (up to 3,000 cycles per hour), engage the same muscle groups without relaxation phases. This continuous activation gradually causes microtears in tendons and overload of peripheral nerves.

In Japanese manicure practice, the focus is not on the polishing technique as a mechanical action but on its kinematics, including the control of movement amplitude, axial pressure, and stabilization of the shoulder girdle. This precise control allows for an accurate assessment of how working postures influence the practitioner's physiological endurance (Table 3).

Table 3

Biomechanical Impact of Typical Working Postures and Micromovements in Manicure Practice on the Musculoskeletal System

Working posture or movement	Biomechanical feature	Affected muscle groups	Potential physiological consequences	Optimizing approach (based on the Japanese school)
Static sitting position for more than 30 minutes without changing support	Reduced venous outflow and tension in the paravertebral muscles	Lumbar and gluteal muscles	Local ischemia, compression of nerve endings	Microbreaks every 45 minutes, unloading posture change
Neck flexion during fine operations (angle > 25°)	Increased pressure in cervical discs	Trapezius and sternocleidomastoid muscles	Tension, tension-type headache	Adjustment of lighting height and frontal projection of the work field

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Forearm rotation during polishing	Incomplete rotational amplitude during repetitive movements	Finger flexors, pronators	Microstrain of tendons, carpal tunnel syndrome	Use of rhythmic sliding with alternating direction
Constant shoulder elevation (working at a high surface)	Excessive activation of upper fibers of the trapezius muscle	Shoulder girdle, neck	Muscle spasms, finger numbness	Lowering table height, symmetrical support of both forearms
Excessive gripping of instruments	Isometric load on interosseous hand muscles	Palmar muscle group	Microtears of tendons, reduced finger sensitivity	Use of instruments with a balanced center of gravity

Source: compiled by the author based on [1, p. 688–690; 2, p. 226–228; 3; 4, p. 855–857; 11; 15].

The application of the parameters presented in Table 3 allows the manicure process to be viewed as a complex biomechanical system, in which the efficiency and safety of movements depend on precise positional control and balanced distribution of loads among muscle groups [1, p. 689–690; 2, p. 227–228]. In practical salon conditions, the combination of fine motor activity and static posture maintenance creates cumulative strain that often goes unnoticed until the onset of fatigue or localized pain. For example, prolonged neck flexion, even at a slight angle, gradually increases compressive pressure in the cervical vertebrae, impairs venous outflow, and reduces concentration during work [1, p. 690]. Similarly, excessive gripping of tools causes microspasms of the interosseous hand muscles, decreasing movement precision and contributing to the development of tendon microtrauma [3].

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In professional practice, the correction of such loads is achieved through the introduction of micro-adjustments in working posture: maintaining a neutral wrist position, controlling chair height, and alternating active work phases with short relaxation breaks. Optimization of fine-movement rhythm and minimization of axial pressure ensure not only physiological comfort for the practitioner but also stability of microkinematics, which enhances the quality of each procedure. When techniques with controlled movement amplitude are applied, muscle fatigue decreases, while motor precision remains stable even after several hours of continuous work [8, p. 52–54].

In practical terms, biomechanically balanced postures not only reduce the risk of developing chronic musculoskeletal disorders but also serve as the foundation of professional longevity, where the practitioner's health becomes an integral component of their mastery.

The organization of a manicurist's work process is characterized by a number of systemic issues that directly contribute to overload of the hands, forearms, and cervical-shoulder region, thereby reducing professional endurance. Most notably, prolonged static fixation of the body without posture changes leads to venous congestion, decreased microcirculation, and local muscle ischemia [1, p. 689–690]. Continuous tool handling in wrist pronation, combined with micro-rotational movements, creates cumulative strain on the tendinous structures, particularly in the finger flexor region, which is a major contributing factor to the development of carpal tunnel syndrome.

A frequent issue is the loss of neutral forearm positioning when the working surface is either too high or too low, resulting in chronic tension of the shoulder girdle muscles [3]. Another contributing factor is the asymmetry of working movements: the dominant hand performs most of the tasks while the non-dominant hand remains passive, causing an imbalance in muscular load distribution and gradual postural deformation [5, p. 66–67]. Additionally, the lack of anatomically

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adapted equipment poses a problem; work tables and armrests often do not correspond to the practitioner's anthropometric parameters, leading to forced shoulder elevation and excessive forward trunk inclination [13, p. 239–240].

Work intensity also plays a significant role: performing a high number of procedures without microbreaks results in the accumulation of muscle fatigue, impaired movement coordination, and a decline in work quality [12, p. 23].

A lack of preventive exercise programs or rotation of work tasks is often observed, which prevents the restoration of muscle tone between procedures. This is compounded by emotional and sensory overload: continuous visual concentration on fine details and precise movements increases tension in the trapezius muscles and cervical stabilizers [6]. As a result, a complex of professional dysfunctions develops, including reduced wrist joint mobility, neck and shoulder pain, postural disturbances, and loss of finger sensitivity, all of which limit the precision of manual actions [1]. These issues highlight the need to implement a biomechanically grounded organization of the work environment, aimed not only at improving efficiency but also at maintaining the practitioner's functional stability.

Optimization of movement biomechanics and workspace ergonomics in Japanese manicure involves comprehensive measures designed to reduce musculoskeletal strain and enhance manual precision without compromising comfort. The foundation lies in establishing a biomechanically neutral posture, in which the practitioner's body remains in static equilibrium while movements are performed through fine, coordinated efforts of the fingers and forearms with a stable torso position. The workstation should be adapted to the practitioner's anthropometric parameters: chair height must allow a knee flexion angle of 90–100°, the table should be positioned at elbow level, and the client's armrest should align with the practitioner's forearm to prevent shoulder elevation and excessive neck flexion.

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An important recommendation is to balance the tempo and rhythm of fine motor movements. The optimal approach involves alternating phases of active polishing with micro-rest phases lasting 10–15 seconds to restore microcirculation in the hand muscles. The use of motor stabilization training protocols is also effective, incorporating exercises for stretching the finger flexors and extensors, isometric strengthening of wrist stabilizers, and coordination drills to restore motor symmetry. The application of biomechanical self-analysis is advisable as well: video recording and subsequent review of movements help identify inefficient postures or excessive axial pressure during technique execution.

From an ergonomic standpoint, it is recommended to use tools with a balanced center of gravity, non-slip handles, and a light weight (up to 30 g), which ensures minimal grip force. The work surface should be matte to prevent visual fatigue, and lighting should be diffused and directed frontally to eliminate the need for head inclination. Regulation of work time is particularly important: after every 50–60 minutes of work, short active breaks should be taken, including movements to relax the cervical and shoulder areas as well as the hands.

In practical terms, the Japanese approach to manicure demonstrates its effectiveness not only as a cosmetic technique but also as a professional preventive system in which technical precision is integrated with biomechanical literacy. Implementation of these recommendations reduces the risk of carpal tunnel syndrome, muscle spasms, and chronic back pain, extends the duration of active professional performance, and fosters a culture of conscious, physiologically safe work within the field of aesthetic services.

Conclusions. The study established that the biomechanics of a manicurist's movements in the Japanese approach determine not only the technical quality of procedures but also the level of occupational safety. It was found that synchronizing fine motor activity with body positioning, maintaining a neutral posture of the spine and wrists, and controlling the rhythm and amplitude of movements significantly

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reduce the risk of microtrauma. The main factors contributing to overload include prolonged static posture, excessive grip force, movement asymmetry, and improper positioning of work surfaces, all of which create musculoskeletal imbalance.

The study also identified that common organizational problems, such as neglect of the practitioner's anthropometric parameters, absence of adjustable furniture, inadequate lighting, and lack of rest breaks, lead to premature fatigue, impaired coordination, and chronic muscle spasms. Insufficient integration of biomechanical and ergonomic knowledge into professional training programs limits the formation of a culture of safe work in the beauty industry.

The scientific and practical recommendations proposed in this study aim to create a biomechanically balanced workspace by ensuring postural symmetry, using lightweight tools with ergonomic handles, optimizing the height of the table and chair, and implementing microbreaks and exercises to relieve tension in the hands and cervical region. The introduction of movement self-analysis methods is advisable to identify excessive strain and correct motor habits.

Future research should focus on developing digital biomechanical simulators and standardized training modules that integrate ergonomics, neuromotor control, and occupational injury prevention. This will contribute to shaping a new model of professional culture in the beauty industry, centered on health, precision, and long-term professional endurance.

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