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Using Myofunctional Devices in the Complex Treatment of Orthodontic Patients: Implementation in the Healthcare Policy System

▷ **Objective.** To determine dentoalveolar and skeletal effects produced in mature patients with low tongue posture by the Carriere Motion Class III (CM3) appliance, followed by fixed appliances and myofunctional therapy by *Froggy Mouth Appliance* (FMA). To justify the need for regulatory implementation of these technologies in clinical practice as part of public health policy, and to establish the legal framework supporting an interdisciplinary approach in orthodontic care.

Methods. This clinical study involved 15 patients diagnosed with mandibular prognathism (Class III malocclusion), aged between 18 and 21 years, divided into two groups.

Patients in Group 1 received conventional treatment using fixed orthodontic appliances (Carriere Motion system and bracket system). In Group 2, treatment was supplemented with the *Froggy Mouth* myofunctional appliance to correct tongue posture. All patients underwent clinical and laboratory assessments.

Results and Discussion: all participants demonstrated high levels of anxiety, with scores exceeding 45 on the Spielberger State-Trait Anxiety Inventory. Furthermore, 86.7% reported experiencing chronic stress (87.5% in Group 1 and 85.7% in Group 2). Most patients associated stress with social factors, minimal social interaction, and the expansion of online learning formats (88.3% in both groups). The average treatment duration in Group 1 was approximately 18 months, compared to 14 months in Group 2. Following the completion of the study, patients in Group 2 were additionally prescribed FMA to normalize tongue posture and prevent relapse.

Scientific Novelty. The findings of clinical and cephalometric examinations of patients in Groups 1 and 2 confirm that primary treatment effects CM III are dentoalveolar with minimal skeletal alterations. The findings of clinical and cephalometric evaluations confirm a significant improvement in tongue posture in Group 2 patients during comprehensive therapy by FMA. We consider the inclusion of the myofunctional appliance (FMA) essential in the multidisciplinary treatment of Class III malocclusion cases where the tongue rests on the floor of the oral cavity. The scientifically justified implementation of myofunctional orthodontic technologies requires appropriate legal regulation at the legislative level. In particular, it necessitates the formal incorporation of relevant provisions into clinical protocols, healthcare service standards, and accreditation requirements for medical professionals. The findings of this study demonstrate not only the clinical effectiveness of the applied technologies but also the urgent need for a legal framework to support an integrated interdisciplinary approach to the treatment of malocclusions.

Conclusions: A tongue positioned low in the mouth during critical growth periods contributes to the stimulation of mandibular development, in line with M. Moss's functional matrix theory of bone growth. For orthodontists, establishing a regular adaptive swallowing pattern is crucial, as it enhances treatment outcomes, reduces treatment time, and helps prevent relapse.

Our findings highlight the effectiveness of labiotherapy developed by Patrick Fellus, as a regular swallowing pattern was achieved in the majority of patients (85.7%) after just four months of therapy.

Legislative recognition of these technologies will facilitate the integration and harmonization of dental, functional, and general medical practices, thereby promoting a more cohesive and interdisciplinary approach to healthcare delivery.

Keywords: *mature patient, Carriere Motion Class III appliance Froggy Mouth appliance, labiotherapy, stress, healthcare, state policy, legal mechanisms.*

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Statement of the problem

Scientific research confirms that stress acts as a catalyst in the development of various diseases [1, 6, 11]. Recently, Ukrainian children have been exposed to prolonged chronic social stress resulting from war, frequent air raid alerts, and the constant fear of losing their homes, loved ones, or even their lives. As a coping mechanism, many of them develop oral habits that help mitigate the impact of this ongoing stress [6, 17]. One of the most common consequences is a shift in tongue posture, accompanied by the emergence of atypical swallowing patterns. Increasingly, these oral habits are seen as adaptive responses to chronic stress [10].

Numerous studies have highlighted the detrimental effects of low tongue posture and mouth breathing on craniofacial development and occlusal formation in children [8, 9]. Researchers emphasize that mouth breathing not only alters facial growth but also significantly contributes to the development of open bites and clockwise mandibular rotation [7, 18]. Nevertheless, both parents and children frequently underestimate the role of oral habits in causing dental anomalies, facial asymmetries, and even cardiovascular disorders. Mouth breathing and low tongue posture are commonly accompanied by another prevalent issue in children today—a poorly developed swallowing reflex in which the tongue muscles do not function properly.

In his theory of functional cranial analysis, M. Moss identifies two types of functional matrices—periosteal and capsular. Periosteal matrices include muscles and teeth, while capsular matrices refer to the volumes enclosed by neurocranial and orofacial capsules. In the neurocranium, the capsular matrix is represented by the brain mass, and in the facial skeleton, it corresponds to the functional space of the oronasopharyngeal cavity [15].

Periosteal matrices exert a direct influence on skeletal structures through processes such as bone formation, resorption, or the proliferation of cartilaginous and fibrous tissues, resulting in changes in the shape and size of bones. In contrast, capsular matrices influence cranial structures indirectly, through changes in the volume of the surrounding capsules, which leads to passive spatial repositioning of these

structures. Thus, cranial development is shaped by both the direct morphological changes induced by periosteal matrices and the spatial translation driven by capsular activity. Physical forces—especially muscle activity—play a crucial role in regulating cellular functions and shaping tissue architecture. In cases of parafunctions such as atypical swallowing, muscle force becomes particularly significant. Researchers have demonstrated that gap junctions function like electrical synapses, forming a network that facilitates communication between bone cells. This supports the idea that all processes of bone adaptation are inherently multicellular in nature. Bone tissue “tunes” itself to the specific frequency of skeletal muscle activity. This perspective incorporates data on intracellular and intercellular mechanisms, as well as mechanotransduction processes in bone cells, viewing bone as a biologically interconnected system. These insights reinvigorate the functional matrix hypothesis by providing a logical chain from epigenetic stimuli, such as muscle contractions, to the hierarchical regulation of gene expression in bone cells. Accordingly, an oral habit—particularly one that involves prolonged mechanical pressure on the facial skeleton or mandible—can trigger deformative processes through cellular mechanotransduction and the development of the bone’s functional matrix. This reflects the phenotypic expression of the human body. Intercellular mechanotransduction is crucial for coordinating remodeling responses in connective tissue and is considered a key initiating factor in the development of acquired craniofacial deformities [15].

In children, chronic abnormal pressure, especially from the tongue, can lead to acquired dentoalveolar deformities and anomalies. These may present as specific classes of malocclusion, displacement of individual teeth or tooth groups, alterations in dental arch shape, jaw misalignment, and irregularities in the positioning of other facial bones [3, 16].

Under normal conditions, the swallowing reflex changes automatically around the age of four. However, chronic stress often disrupts this natural transition, for instance, by preventing the shift in dominance from the facial nerve to the trigeminal nerve. As noted by E. Kandel, all habits and learned skills are ultimately products of nervous system activity [9].

Effective treatment of any pathology should begin with identifying its root cause. In numerous instances, the primary etiological factor is abnormal tongue posture. Additional contributing factors include the underdevelopment of the upper jaw, which leads to narrowing of the nasal passages and the development of Class III malocclusions. Specialized myofunctional appliances, such as **FroggyMouth**, can help *train* the tongue to maintain a position that reduces its pressure on mandibula in patients with class III [3, 4]. Therefore, it is worthwhile to investigate further the potential need for myofunctional therapy in patients with abnormal tongue posture.

This clinical study involved 15 patients diagnosed with mandibular prognathism (Class III malocclusion), aged between 18 and 21 years. Participants were randomly divided into two groups: Group 1 consisted of eight individuals, while Group 2 comprised seven individuals, with randomization performed based on age and gender.

Inclusion criteria:

- Age between 18 and 21 years;
- Presence of dentofacial anomalies and acquired deformities consistent with Class III malocclusion;
- Presence of oral habits such as atypical swallowing or tongue resting on the floor of the mouth.

Exclusion criteria:

- Age below 18 or above 21 years;
- Facial asymmetries caused by genetic syndromes;
- History of cranial trauma (e.g., skull fractures).

Statistical Analysis and Data Presentation

Descriptive statistics were presented in terms of absolute numbers and percentages. To compare proportions between groups, the chi-square test and the paired proportion test were used (software: **R**, version 4.0, <https://www.R-project.org>). Graphical representations were also created using **R** to illustrate the distribution of the data.

Treatment Methods

Patients in Group 1 received conventional treatment, which included fixed orthodontic appliances—specifically the Carriere Motion appliance III and SLX 3D Brackets system. Group 2 patients underwent the same orthodontic treatment, supplemented by the FroggyMouth myofunctional appliance to normalize tongue posture.

Results and Discussion

All participants demonstrated high anxiety levels, with scores exceeding 45 on the Spielberger State-Trait Anxiety Inventory. Furthermore, 86.7% of the



Fig.1. Schematic representation of anterior tongue thrust in patients with Class III occlusion

participants reported experiencing chronic stress (87.5% in Group 1 and 85.7% in Group 2). Most patients attributed their stress to social factors, such as reduced interpersonal communication and the widespread adoption of online learning. In addition, 93.3% of participants reported the presence of either oral or postural habits, or both, with postural habits being more dominant. Oral habits included tongue-thrusting between the teeth and tongue resting on the floor of the mouth (Fig. 1).

Notably, 73.3% of patients stated that these habits provided emotional relief. In patients from Groups 1 and 2, both males and females exhibited a consistent trend toward retrusion of the maxilla compared to the control group. Mandibular prognathism was also evident across both sexes undergoing therapy with CM III. Vertically, individuals in Groups 1–2 demonstrated a greater lower anterior facial height (ANS-Me) and a more pronounced mandibular plane angle compared to those with near-ideal occlusal alignment. According to the results of the clinical study, all patients in both Group 1 and Group 2 exhibited atypical swallowing patterns and tongue posture located on the floor of the oral cavity.

In contrast, all individuals in the control group demonstrated a regular swallowing pattern. The average treatment duration for patients in Group 1 was approximately 18 months, whereas it was 14 months for those in Group 2. In all cases, it was essential to normalize tongue posture, as patients with Class III malocclusion typically present with a low tongue position resting on the floor of the mouth. Such cases require retraining of tongue

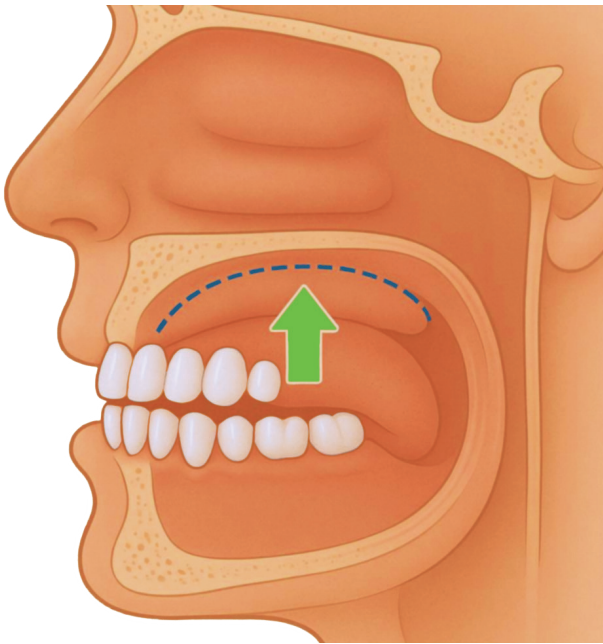


Fig.2. Schematic representation of a normal swallowing pattern

function to reposition it on the palate. Since the tongue plays a critical role in post-treatment relapse, it is necessary to address its functionality throughout therapy.

This goal was most effectively achieved through anoetic myofunctional therapy using the Froggy-Mouth Appliance (FMA). Group 2 patients began their treatment with this device as a myocorrective intervention. Within 2 months, 85.7% of Group 2 patients had achieved Stage 1 (initial improvement in tongue posture). Transition to Stage 2, indicating the development of a correct swallowing pattern, occurred in 6 patients (85.7%) after 4 months of anoetic therapy, while one patient (14.3%) required 7 months to achieve an automated swallowing reflex (Fig. 2). Notably, none of the patients in Group 1 (100%) developed a regular swallowing pattern despite undergoing myogymnastic therapy without the use of FMA. Upon completion of the study, all Group 1 patients were subsequently prescribed FroggyMouth appliances to normalize tongue posture and prevent relapse.

Cephalometric analysis revealed minimal skeletal changes in all patients, with most improvements observed at the dentoalveolar level. These modifications contributed to an improved quality of life, suggesting that this combined therapeutic approach could serve as a non-surgical alternative to orthognathic surgery for Class III patients with mild alveolar discrepancies. Our findings are consistent with those of other researchers, who also emphasize that dentoalveolar changes are more pronounced than skeletal alterations [2]. The treatment duration

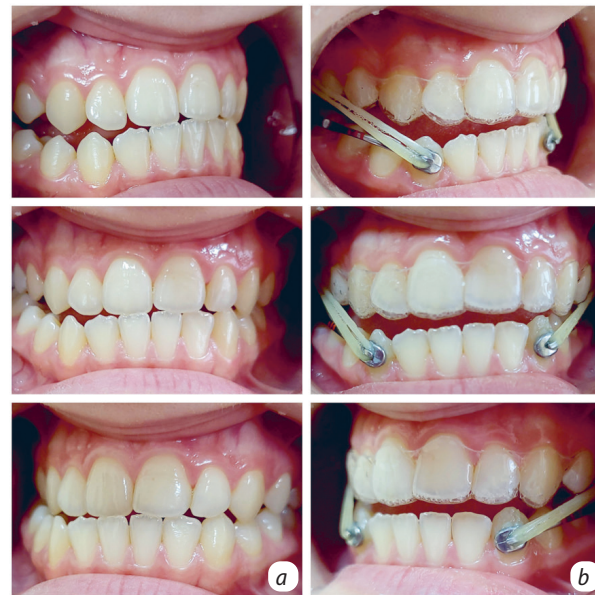


Fig. 3. Patient Y, 20 years old. Diagnosis: Class III malocclusion, oral habit: tongue resting on the floor of the mouth (a), Intraoral view of a Class III patient during steps of treatment (placement of CM appliance) (b).



Fig. 4. Labiotherapy using the FroggyMouth appliance.



Fig. 5. Intraoral view of a Class III patient during steps of treatment (placement of CM appliance, bracket system placement, treatment outcome following comprehensive therapy).

using the conventional treatment protocol without myofunctional rehabilitation in our Group 1 patients was comparable to the results reported by other researchers [13, 14, 19].

Clinical Case: Patient Y, 20 years old, diagnosed with Class III malocclusion, presented with a harmful oral habit—tongue resting on the floor of the mouth and tongue-thrusting between the teeth during swallowing (Fig. 3). The treatment plan included anoetic retraining of swallowing function using the FroggyMouth appliance (Fig. 4–5).

The patient Y, 20 years old. Diagnosis: Class III malocclusion, with an oral habit: tongue resting on the floor of the mouth was treated using a Carriere Motion Class III (CM3) and FroggyMouth (FM) Appliance, SLX 3D Brackets system. After treatment, only minor skeletal alterations were detected in the sagittal dimension, with a slight increase in lower anterior facial height noted throughout the treatment period. Most observed changes were primarily dentoalveolar. Additionally, treatment led to a modification of the functional Curve of Wilson, resulting in an enhanced functional and dynamic occlusion. The FroggyMouth appliance contributed to the normalization of tongue posture and facilitated the development of a proper swallowing pattern, establishing an automated and stable reflex within four months after the beginning of treatment. We believe that the extended time required to develop this skill is linked to the patients' experience of living in wartime conditions, which has resulted in chronic social stress.

Considering the high effectiveness of myofunctional therapy, it is essential to identify effective steps in the healthcare sector to implement and standardize methods for treating harmful oral habits. According to the Law of Ukraine *Fundamentals of Legislation of Ukraine on Healthcare* (1993), the primary principles of medical services are accessibility, quality, and efficiency of healthcare services for all citizens. In particular, Article 2 of the law states that the state ensures citizens' right to health protection and creates conditions for access to quality medical services. This emphasizes the importance of establishing a legal framework to ensure patients' access to innovative treatment methods, such as myofunctional therapy.

The law establishes the state's obligation to support the development of new medical technologies and treatment methods, ensuring their proper certification and accreditation through relevant authorities, which is a prerequisite for their implementation in medical practice. Myofunctional therapy, including the use of specialized devices such as FroggyMouth, plays a significant role in dental treatment. It is necessary to legally approve the introduction of myofunctional devices and methods into state medical guarantee programs and include them in the standards for providing medical services. This would ensure the accessibility of these treatment methods to all population

categories, which is an essential part of the state's healthcare policy.

The Law of Ukraine *On State Financial Guarantees for Public Healthcare* (2018) outlines the state financial guarantees for providing patients with necessary healthcare services and high-quality medical goods, including reimbursement for medicines and medical devices (including assistive devices) from the State Budget of Ukraine under the medical guarantee program. Therefore, state policy should focus on ensuring the availability of healthcare services for a broad range of patients, particularly in the field of correcting harmful oral habits. The implementation of myofunctional therapy in Ukraine should be based on funding mechanisms for these treatment methods through medical programs or health insurance. For effective implementation of this policy, myofunctional therapy should be included in the national medical guarantee program. This will ensure equal access to such services and reduce financial barriers for patients.

Myofunctional therapy, particularly with devices like FroggyMouth, is actively being implemented in international practice, but to enable its widespread use in Ukraine, a legal foundation must be created that includes the certification of new methods and technologies. The introduction of this technology into the healthcare system should be reflected in national clinical protocols that regulate the provision of medical care in the field of dentistry and correction of oral habits.

Myofunctional methods should be integrated into existing clinical protocols and dental care service standards. Including these methods in the list of state medical services will improve the quality of treatment and ensure accessibility for all population categories. Considering international experience, national legislation should be enhanced, including the creation of relevant qualification requirements for specialists conducting myofunctional correction.

Special attention should be given to the interdisciplinary approach in treating harmful oral habits, as conditions like atypical swallowing, malocclusions, and others require a comprehensive approach. It is advisable to provide for the interaction of the following specialists:

1. **Orthodontists**, who determine the clinical strategy for correcting dentoalveolar anomalies, using myofunctional devices to normalize oral functions.
2. **Speech therapists**, who correct speech disorders, including improper swallowing, articulation issues, and help patients restore proper swallowing and breathing functions.
3. **Physiotherapists**, who may use specialized methods aimed at improving facial muscle tone,

which is important for correcting jaw positioning and other anatomical issues.

4. **Psychologists and psychotherapists**, who provide emotional support for patients, especially children, who experience stress and unpleasant emotions due to the need to wear orthodontic appliances. Psychological support is also important for correcting habits that arise in stressful situations or due to social factors, such as interactions in child groups or self-esteem problems.

5. **Therapists**, who may be involved in treating parafunctions, such as bruxism or issues with chewing muscles, which are part of the overall picture of harmful oral habits.

Through this approach, the patient not only receives correction of dentoalveolar anomalies but also an improvement in the functional state of the oral cavity, which reduces the risk of relapse and improves treatment outcomes. Each specialist contributes to restoring functions, ensuring more effective and comprehensive treatment and prevention.

The implementation of myofunctional therapy as an official treatment method is a necessary step to improve the accessibility and quality of dental care in Ukraine. This requires not only legal support but also the development of appropriate medical standards and training programs for specialists. Implementing such changes will enhance the effectiveness of patient treatment.

Conclusions

1. Treatment with the Carriere Motion Class III appliance, and SLX 3D bracket system resulted in minimal skeletal changes in the sagittal plane. A modest increase in lower anterior facial height was observed over the course of treatment, with most of the treatment effects being predominantly dentoalveolar in nature. FroggyMouth appliance reduces the overall duration of treatment with fixed orthodontic appliances.

2. We suggest that most harmful oral habits, as well as a patient's inability to develop a stable adaptive swallowing pattern, are directly influenced by the condition of the nervous system and surrounding stress-related factors. A tongue resting on the floor of the mouth during active growth periods stimulates mandibular development, in accordance with M. Moss's functional matrix theory of skeletal growth.

3. The use of labiotherapy enables the clinician to actively address both primitive swallowing patterns and deleterious habits such as low tongue posture and tongue-thrusting during swallowing.

4. For orthodontists, the development of a normal adaptive swallowing reflex is critically important, as it contributes to successful treatment outcomes, reduces treatment time, and prevents relapse. Our study confirms the effectiveness of Patrick Fellus' labiotherapy method, as a proper swallowing pattern was achieved in the majority of patients (85.7%) within four months.

5. The implementation of myofunctional therapy as an official treatment method for harmful oral habits is a significant step towards improving the accessibility and quality of dental care in Ukraine. This requires enhancing the existing legislation in terms of certifying innovative methods and technologies, such as myofunctional devices, and integrating these techniques into state medical programs and clinical protocols.

6. Ensuring access to innovative treatment methods should be supported by funding through state medical guarantees, which will help reduce financial barriers for patients. Considering the high potential of myofunctional therapy, an interdisciplinary approach involving orthodontists, speech therapists, physiotherapists, psychologists, and therapists should become the foundation of effective treatment and prevention of harmful oral habits, ensuring comprehensive and long-term correction of functional disorders.

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Використання міофункціональних апаратів у комплексному лікуванні ортодонтичних пацієнтів: впровадження в систему державної політики охорони здоров'я

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Мета: Визначити дентоальвеолярні та скелетні ефекти, які спостерігаються у пацієнтів зрілого віку з низьким положенням язика після лікування за допомогою апарата Carriere Motion Class III (СМ3), з подальшим застосуванням фіксованих ортодонтичних апаратів та міофункціональної терапії за допомогою апарата Froggy Mouth (FMA). Обґрунтувати необхідність нормативного врегулювання впровадження таких технологій у клінічну практику в межах державної політики охорони здоров'я та правового забезпечення міждисциплінарного підходу в ортодонтичному лікуванні.

Методи: У цьому клінічному дослідженні взяли участь 15 пацієнтів із прогнатією нижньої щелепи (III клас прикусу) віком від 18 до 21 року, розподілених на дві групи.

Пацієнти першої групи отримували традиційне ортодонтичне лікування із використанням системи Carriere Motion та брекет-системи. У другій групі лікування доповнювалось міофункціональним апаратом Froggy Mouth для корекції положення язика. Усі пацієнти пройшли клінічне та лабораторне обстеження.

Результати та обговорення: Усі учасники продемонстрували високий рівень тривожності (за шкалою Спілбергера понад 45 балів). Крім того, 86,7 % повідомили про хронічний стрес (87,5 % у групі 1 та 85,7 % у групі 2). Більшість пацієнтів пов'язували

стрес із соціальними чинниками, зокрема обмеженим спілкуванням та розширенням форматів онлайн-навчання (88,3 % у обох групах). Середня тривалість лікування у першій групі становила приблизно 18 місяців, тоді як у другій — 14 місяців. Після завершення дослідження пацієнтам другої групи додатково було призначено FMA для нормалізації положення язика та профілактики рецидивів.

Наукова новизна: Клінічні та цефалометричні дослідження пацієнтів обох груп підтверджують, що основний ефект лікування апаратом СМЗ є дентоальвеолярним, зі незначними скелетними змінами. У пацієнтів другої групи спостерігалось суттєве покращення положення язика під час комплексної терапії з використанням апарата FMA. Ми вважаємо використання міофункціонального апарата Froggy Mouth доцільним і необхідним етапом у міждисциплінарному лікуванні пацієнтів із прикусом III класу, у яких язик розташований на дні ротової порожнини.

Науково обґрунтоване впровадження міофункціональних ортодонтичних технологій потребує належного правового регулювання на законодавчому рівні, а саме нормативного закріплення відповідних положень у клінічних протоколах, стандартах надання медичної допомоги та вимогах до акредитації медичних фахівців. Результати дослідження засвідчують не лише клінічну ефективність використання зазначених технологій, але й необхідність правового забезпечення інтегрованого міждисциплінарного підходу до лікування патологій прикусу.

Висновки: Язик, що знаходиться на дні ротової порожнини у критичні періоди росту, стимулює розвиток нижньої щелепи відповідно до теорії функціональної матриці кісткової тканини за М. Моссом. Для ортодонтів важливим є формування нормального акту ковтання, що сприяє ефективності лікування, скороченню його тривалості та профілактиці рецидивів. Наші результати підтверджують ефективність методики лабіальної терапії, розробленої Патріком Феллюсом: у більшості пацієнтів (85,7 %) вже через 4 місяці спостерігалось формування нормального типу ковтання.

Дослідження засвідчує потребу у нормативно-правовому врегулюванні впровадження міофункціональних технологій у клінічну практику. Впровадження міофункціональних апаратів у контексті державної політики потребує міждисциплінарного підходу, заснованого на доказовій медицині. Визнання таких технологій на законодавчому рівні сприятиме гармонізації стоматологічної, функціональної та загальної медичної практики.

Ключові слова: пацієнти зрілого віку, апарат Carriere Motion Class III, апарат FroggyMouth, лабіотерапія, стрес, державна політика, охорона здоров'я, правові механізми.

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