ABSTRACT

of the dissertation work by Kuvatbayeva Urnissyam Alimzhanovna
on the topic: «Treatment of dentin caries using the air-abrasion method in children with autism spectrum disorder»,
submitted for the degree of Doctor of Philosophy (PhD)
in the specialty 8D10102 – Medicine

Scientific Supervisors:
Candidate of Medical Sciences,
Associate Professor **Iskakova M.K.**

International Scientific Consultant:
Doctor of Medical Sciences, Professor **Rizaev Zh.A.**

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Relevance of the research topic.

Autism spectrum disorders (ASD) represent a group of complex disintegrative developmental disorders characterized by impaired communication and social interaction, as well as a tendency toward stereotypical behaviors. Symptoms appear in early childhood, and all of the above-mentioned deviations lead to social maladaptation. According to the Republican Scientific and Practical Center for Mental Health, 4,887 patients with autism spectrum disorder were under dynamic observation as of December 31, 2021 [1]. The number of children with ASD increases every year, and in 2021, a total of 1,184 children with ASD were registered.

The growing prevalence of ASD among the pediatric population represents one of the most pressing issues in healthcare. Autism impacts the condition of the child's oral cavity. It has been proven that one of the urgent problems in pediatric dentistry is determining the relationship between the child's comorbidities and their dental status [2]. Available literature sources indicate that the dental morbidity of children with ASD is significantly higher than that of somatically healthy children [3]. This is associated with several factors: a slower rate of perception, underdevelopment of cognitive functioning, impaired behavioral responses, and, consequently, inadequate adherence to necessary oral hygiene procedures.

According to O.G. Avraamova and Yu.V. Pakhomova [4], the prevalence of dental caries in children with ASD aged 3 to 15 years reaches 90%, accompanied by poor oral hygiene. Dental caries is a problem of not only medical but also social importance. Children with carious teeth become irritable; chewing becomes difficult, and the child tries to avoid chewing on the side of the affected tooth, which may eventually lead to temporomandibular joint dysfunction and abnormalities in the development of the dentoalveolar system. Since teeth play an important role in proper speech formation, active verbal communication, and sociability at any age, and therefore in the adequacy of mental and behavioral responses, the presence of carious lesions and dentoalveolar anomalies further exacerbates communicative and behavioral difficulties with others [5].

The problem of dental treatment in children with autism spectrum disorder becomes increasingly urgent each year due to the high prevalence of dental diseases and their chronic course in the pediatric population [6]. Two major unifying factors among children with ASD are:

1) a high level of psychoemotional response to dental interventions, and

2) a deterioration in oral hygiene.

The classical method of treating dental caries is mechanical preparation of the carious cavity. However, during dental rehabilitation of children with ASD, significant difficulties arise: treatment is complicated, and the administration of anesthesia becomes an additional source of stress for the patient [7,8]. One of the alternative approaches is the air-abrasion method of tooth preparation, which enables gentle and painless removal of affected tissues [9,10]. This method can help reduce dental morbidity rates, improve prevention and treatment of dental caries in children with ASD, and enhance their quality of life, which determines the relevance of this study.

The use of the air-abrasion method for the treatment of dentin caries in children with ASD is recommended for inclusion in the compulsory social health insurance program at the level of primary health care (PHC). According to the clinical protocols of the Ministry of Health of the Republic of Kazakhstan, children with ASD are entitled to free dental treatment using the traditional method of cavity preparation and local anesthesia. However, when sedation, general anesthesia, or non-invasive methods are required, dental treatment is provided on a paid basis.

In view of the above, the treatment of dentin caries in children with autism spectrum disorder is highly relevant for practical healthcare, as it contributes to improved oral health and enhanced quality of life.

The aim of the dissertation research is to improve the treatment of dentin caries using the air-abrasion method in children with autism spectrum disorder.

Research objectives

1. To assess the effectiveness of dentin preparation using air-abrasion and traditional methods through atomic force microscopy.

2. To evaluate the prevalence and intensity of dental caries in children with ASD depending on age during preventive examinations, and to assess the level of dental care based on questionnaire data.

3. To assess the emotional state of children with ASD using the “Positive and Negative Affect Schedule (PANAS)” before and after treatment.

4. To evaluate the condition of carious lesions using the “Diagnodent” laser device before treatment in children with ASD.

5. To determine the pain threshold using the Freeze test during dental treatment of dentin caries in children with ASD.

6. To develop methodological recommendations for the treatment of dentin caries in children with ASD for practicing healthcare providers and medical university students.

Research Methods

The dissertation is based on a prospective longitudinal randomized blind dental study involving children with autism spectrum disorder in the city of Almaty. The dissertation research was carried out within the framework of a scientific project in

collaboration with the Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan and the Kazakhstan-Russian Medical University on the topic: “An interdisciplinary approach to the comprehensive assessment of the health of children with disabilities” (Memorandum of Cooperation dated December 11, 2023), as well as the scientific project “Innovative method for the treatment of dental caries in children with autism spectrum disorder”, registered in the National Center for State Scientific and Technical Expertise (registration number 0123РКИ0377, dated November 20, 2023).

To assess the prevalence and intensity of the carious process depending on age and comorbidities in children with autism spectrum disorder, a preventive dental examination (based on patient visits) was conducted at the Department of Therapeutic and Pediatric Dentistry of the Non-profit Entity “Kazakhstan-Russian Medical University.”

The study population consisted of children aged 5–6 years who had already been diagnosed with autism spectrum disorder (ASD).

Research Methods

1. To demonstrate the effectiveness of dental caries treatment using the air-abrasion method in comparison with the traditional method, atomic force microscopy was employed. Sections of extracted teeth were examined at magnifications of ×50 and ×100.

2. A preventive dental examination was performed, including completion of the dental chart and calculation of the DMF+dmf indices, which determined the prevalence and intensity of dental caries. Based on questionnaire responses from the legal guardians of children with ASD, behavioral reactions ranging from calm behavior to aggression were identified and taken into account during dental treatment.

3. Calculation of the “Positive and Negative Affect Schedule (PANAS)” prior to treatment showed that positive emotional states facilitated painless caries treatment, influencing the children’s behavioral responses, mood, and the achievement of favorable oral sanitation outcomes. After treatment, children with positive emotional states willingly returned for follow-up procedures.

4. The radiographic method was used before treatment for diagnostic purposes and after treatment as one of the criteria for assessing treatment effectiveness.

5. The depth of the carious lesion was measured using a specially designed graduated probe with a non-traumatic tip, as well as with the “Diagnodent” laser device, in order to confirm the final diagnosis of “dentin caries.”

6. At the stage of examination and diagnosis, the pain threshold was determined using the Freeze test (assessment of pulp response to thermal stimulation).

7. Statistical analysis was performed to process the obtained data and verify statistical significance. Differences were considered statistically significant at $p < 0.05$.

Object of the Study

Children aged 5 – 6 years with mild ASD and a subcompensated form of dental caries.

During the preventive examination, 1330 patients with ASD aged 3 to 12 years were examined.

Assignment to groups was carried out in accordance with the criteria of sample homogeneity, considering inclusion and exclusion criteria.

For the clinical part of the study, patients were divided into two groups:

Group 1 (main group): 40 patients aged 5–6 years with mild ASD; dental caries treatment was performed using the air-abrasion method.

Group 2 (comparison group): 40 patients aged 5–6 years with mild ASD; dental caries treatment was performed using the traditional method.

Subject of the Study

Extracted teeth previously treated for dentin caries and prepared using either the air-abrasion method or the traditional method.

In the first (main) group**,** 15 teeth diagnosed with dentin caries (upper and lower molars), extracted due to natural replacement and previously treated using the air-abrasion method, were examined.

In the second (comparison) group**,** 15 teeth diagnosed with dentin caries (upper and lower molars), extracted due to natural replacement and previously treated using the traditional method, were examined.

Key Provisions Submitted for Defense

1. Atomic force microscopy confirmed the effectiveness of air-abrasion cavity preparation in treating dental caries in children with ASD, as evidenced by the preservation of the integrity of the cavity floor and the absence of a smear layer and dentin debris, unlike in the traditional treatment method.

2. The high prevalence and intensity of dental caries in children with ASD are due to the low coverage of dental examinations, which leads to poor oral hygiene and early loss of primary and permanent teeth as a result of untimely treatment.

3. During the study, a utility model was developed—a graduated probe with a non-aggressive tip for painless probing and determination of carious cavity depth.

4. The “Positive and Negative Affect Schedule (PANAS)” in children with ASD made it possible to assess emotional state, develop an adaptation algorithm for dental visits, and increase the rate of return visits for follow-up examinations.

5. Caries detection using the “Diagnodent” laser device and the Freeze test improved diagnostic accuracy, allowing visualization of previously undetectable areas of demineralization during visual inspection and assessment of pulp response to thermal stimuli.

6. Comparative evaluation of treatment outcomes confirmed the high effectiveness of air-abrasion therapy for dental caries, evidenced by reduced complications such as filling loss, absence of pain response to stimuli, and fewer repeated visits.

7. The application of the air-abrasion method for the treatment of dentin caries in children with ASD is recommended for practical healthcare and the educational

process. The proposed set of diagnostic and therapeutic measures will help improve the dental status of children with ASD and reduce the risk of caries development.

Description of the Main Research Findings

The results of the study demonstrated a high prevalence and intensity of dental caries among children with ASD. Among the 1330 examined children, the prevalence of dental caries reached 98.6%, while the proportion of healthy teeth amounted to only 1.4%. Within the total group, psychological, somatic, and dental status disorders, as well as the degree of autism spectrum severity, were most frequently observed at the age of six, with the number of boys exceeding the number of girls ($\chi^2 = 2.10$; $p = 0.14812$).

The peak of dental morbidity at the age of 5–6 years is explained by the physiological transition from primary to permanent dentition, as well as by the routine comprehensive dental examinations associated with school enrollment. These factors create optimal conditions for monitoring, treatment, and rehabilitation of the oral cavity.

It was proven that the intensity of dental caries is directly related to the degree of ASD. During the preventive examinations, various levels of caries activity were recorded among all children with ASD.

With the compensated form of caries: mild ASD was observed in 78 children (5.86%); moderate — in 131 (9.85%); severe — in 22 (1.65%).

With the subcompensated form: mild ASD — in 178 children (13.38%); moderate — in 199 (14.96%); severe — in 72 (5.41%).

With the decompensated form: mild ASD — in 218 children (16.39%); moderate — in 298 (22.41%); severe — in 115 children (8.65%).

These results are explained by the fact that regardless of the severity of ASD, children commonly show poor oral hygiene or a complete lack of oral care; untreated oral cavity; problematic behavior during dental visits; refusal of treatment; or a complete absence of dental care. The obtained results are statistically significant ($p < 0.01$).

The high caries intensity observed in children with moderate and severe ASD indicates poor oral hygiene, lack of oral care skills and parental control, a predominance of soft foods in the diet, and infrequent (non-systematic) dental visits, often only in the presence of acute dental pain. In addition, problematic behavior during dental appointments, refusal of treatment, or complete avoidance of dental care create favorable conditions for the development of pathogenic oral microflora, multiple dental caries lesions, and the progression of complicated forms such as pulpitis and periodontitis. This leads to early loss of primary and permanent teeth, malocclusions, and dentoalveolar abnormalities.

In this regard, a myogymnastic device was used to train masticatory and lingual muscles, as well as to correct pronunciation, breathing, and articulation.

The results of the assessment by sex demonstrated a high level of caries intensity among both boys and girls. Moreover, depending on the degree of ASD, caries intensity remained significantly high across all severity levels.

The results of questionnaires completed by parents/guardians of children with ASD confirmed that behavioral responses vary widely and depend directly on the severity of ASD, the child's age, the child's mood, the mood of the parents/guardians, and their ability to communicate with the child in stressful situations.

To establish a diagnosis, the clinical-anatomical classification and the WHO classification of dental caries were used. All clinical forms of carious lesions were diagnosed based on the depth of hard tissue involvement. The largest proportion consisted of children diagnosed with "moderate dental caries" or "dentin caries"—91.25%.

During the examination, complicated forms of dental caries were identified: chronic forms of pulpitis and periodontitis, as well as chronic pulpitis and periodontitis in the stage of exacerbation, in 29 children, including 24 boys (30%) and 5 girls (6.25%). The most frequently affected surfaces were the occlusal surfaces of molars: in 73 children (91.25%); the occlusal-proximal surfaces of molars—7 children (8.75%). Demineralization lesions on the proximal surfaces of central and lateral incisors were observed less frequently.

Due to the specifics of ASD, children often display emotional and frequently negative reactions during dental treatment. Even the sound of dental equipment alone can trigger various responses such as fear, screaming, crying, and other forms of distress. To assess positive and negative emotional responses using the "PANAS" scale, data were obtained in both the main and comparison groups.

Air-abrasion cavity preparation proved to be the most effective approach: after treatment, children demonstrated predominantly positive emotions regarding the treatment process. An improvement in mood and motivation for further dental treatment was observed in 80% of the children. With the traditional treatment method, the proportion of children experiencing negative emotions increased from 32.5% to 40% after treatment; 90% of children reported worsening emotional responses and refused further dental care.

The results of the PANAS scale confirm the effectiveness of the air-abrasion method for treating dental caries in children with ASD. This technique allows for pain-free caries treatment without anesthesia, positively influences children's behavioral responses and emotional state, and contributes to improved oral rehabilitation outcomes.

Using the "Diagnodent" laser device, areas of demineralization were identified, optimal restorative materials were selected, and preventive regimens for the main dental diseases were adjusted.

In cases of damaged dental hard tissues due to caries, the freeze-test—based on cold thermal stimulation—was widely used. The freeze-test allowed identification of

the causative tooth, assessment of nerve fiber response to thermal stimuli, and ensured proper diagnosis and treatment planning.

Eighty children diagnosed with dentin caries were offered two treatment methods: the air-abrasion method and the traditional method. The distribution of teeth between the groups was identical. The most frequently affected teeth were the upper and lower molars: 5.5; 6.5; 7.4; 8.4.

In both groups, regardless of the chosen treatment method, the stages of cavity preparation were similar and included several steps: opening the carious cavity, removing overhanging enamel edges, necroectomy of pathological hard tissues, antiseptic treatment, application of an SDR insulating liner, and the use of Neo Spectra flowable composite as the permanent restorative material. Our task was to restore the tooth hard tissue defect with the filling material and ensure the durability of the restoration to prevent early loss of primary teeth.

When using the air-abrasion method, treatment outcomes were significantly more effective compared to the traditional method. During treatment, children remained calm, opened their mouths easily, and were not fearful, as air-abrasion preparation allows painless and silent removal of tooth hard tissues. Excellent clinical results were obtained, confirming the effectiveness of the air-abrasion method. During the procedure, smooth cavity walls and rounded angles are formed, which reduces stress in dentin and prevents crack formation. Additionally, no smear layer is created after preparation, allowing bonding to be omitted when using composite restorative materials. Treatment of two to three teeth can be performed in a single visit, reducing the number of appointments.

In both groups, parents/guardians were provided with oral hygiene recommendations. Follow-up examinations were conducted at 3 months, 6 months, and 1 year to assess treatment quality. During examinations, the condition of the restoration, its integrity, presence or absence of pain, probing, percussion, response to thermal stimuli, radiographic findings, and oral mucosa condition were evaluated.

Follow-up results in the main group:

3 months: Neither patients nor their guardians reported pain; no chips or cracks in the filling were observed during probing; percussion was negative; the oral mucosa was pale pink without pathological changes; no response to thermal stimuli.

6 months: One patient had a chipped restoration and a positive response on the caries detector, and 5 patients (12.5%) demonstrated a response to thermal stimuli.

1 year: Nine children (22.5%) reported pain in response to thermal stimuli; among them, 4 (10%) had positive probing, 1 (2.5%) had a positive percussion test, with radiographic findings showing a demineralization focus and moderate widening of the periodontal ligament.

In the comparison group, at the 3-month follow-up, complaints of tooth pain, chipping, and loss of the restoration were reported, along with short-term pain from thermal stimuli in 9 children (22.5%). At 6 months, 11 children (27.5%) reported tooth pain, restoration loss was recorded in 17 children (42.5%), short-term pain in 8

children (20%), and prolonged pain in 9 children (22.5%). At the 1-year follow-up, 15 children (37.5%) complained of pain in response to thermal stimuli; among them, 8 children (20%) showed positive probing, 7 children (17.5%) had positive percussion, and radiographs revealed demineralization foci with moderate widening of the periodontal ligament.

Thus, treatment of dentin caries using the air-abrasion method in children with ASD is effective, painless, and atraumatic. We recommend this method for practical healthcare as the safest and most acceptable option for all categories of children.

Justification of Scientific Novelty

- The effectiveness of air-abrasion preparation of dental hard tissues was proven using atomic force microscopy, showing no excessive destruction of tooth structure and well-defined layering within the carious cavity.
- For the first time, a high prevalence and intensity of dentin caries depending on age and sex were documented in children with ASD.
- For the first time, a gentle method for determining the depth of the carious cavity was implemented (Patent No. 9504, Appendix A).
- For the first time, the "Oral Hygiene Algorithm for Children with Autism Spectrum Disorder" was proposed (Author's Certificate No. 60652, 2025, Appendix B).
- For the first time, the Positive and Negative Affect Schedule (PANAS) was applied to assess the dynamics of emotional states in children with ASD during dental treatment.
- For the first time, dentin caries detection was performed using the Diagnodent laser device in children with ASD prior to treatment.
- For the first time, the pain threshold was determined using the Freeze test during dentin caries treatment in children with ASD.
- For the first time, the clinical effect of air-abrasion treatment for dentin caries in children with ASD was demonstrated.
- For the first time, the "Myogymnastic Device for Children with Autism Spectrum Disorder" was developed (Patent No. 36902, Appendix C).

Practical Significance of the Obtained Results

1. Based on the conducted research using atomic force microscopy, the air-abrasion method of treating dental caries was proposed as the most painless, gentle, and atraumatic approach.
2. The use of a specially graduated probe with a non-aggressive tip during examination of carious teeth allows painless determination of the depth of the carious cavity for accurate diagnosis.
3. The proposed "Oral Hygiene Algorithm for Children with Autism Spectrum Disorder" (Author's Certificate No. 60652, 2025) enables the development of oral hygiene skills, promoting adherence to hygiene rules and reducing caries progression.

4. The use of the Positive and Negative Affect Schedule (PANAS) to assess the dynamics of emotional states in children with ASD during dental treatment enhances treatment effectiveness.

5. Determination of the pain threshold using the Freeze test facilitates accurate diagnosis of dental caries in children with ASD.

6. The proposed method for treating dental caries in children with ASD (Author's Certificate No. 61069, 2025) increases treatment efficiency (Appendix G).

7. The proposed diagnostic and treatment methods for dental caries using the graduated probe and air-abrasion technique have been implemented in dental clinics and private practices in Almaty and Samarkand (Uzbekistan) (implementation acts 2023, 2024). The research results are also used in the educational process at the Kazakhstan-Russian Medical University (2023, 2025) and have been integrated into practical healthcare in Almaty (Appendices D, E).

Personal Contribution of the Doctoral Candidate

The author personally conducted a comprehensive literature review, developed the research design including inclusion and exclusion criteria for the prospective study, and directly performed: assessment of dental hard tissue condition using atomic force microscopy, dental examinations, surveys of parents/guardians of children with ASD, dental treatment procedures, statistical analysis of the obtained results, interpretation and discussion of findings, preparation of scientific articles and presentations for conferences, implementation of scientific results in practical healthcare and education, and writing of the dissertation.

Conclusions

1. Using atomic force microscopy, it was established that air-abrasion cavity preparation preserves intact dentin, maintains the integrity of the cavity floor, and eliminates dentin debris and smear layer. In contrast, traditional preparation results in layered cavity walls with terrace edges covering almost the entire surface, central cracks on the cavity floor, and uneven, deformed mantle dentin with wavy dentin layers indicative of mechanical processing.

2. A high prevalence and intensity of dental caries among children with ASD were confirmed. The prevalence of caries was 98.6%, while healthy teeth accounted for only 1.4%. Moderate ASD: Mild ASD in the compensated form - 131 children (9.85%); subcompensated - 199 (14.96%); decompensated - 298 (22.41%). Compensated - 22 children (1.65%); subcompensated - 72 (5.41%); decompensated - 115 (8.65%). Girls with mild ASD: highest caries involvement in the decompensated stage - 49 (19.07%); subcompensated - 37 (14.4%); compensated - 20 (7.78%); 5 girls (1.95%) had healthy, previously treated oral cavities. Girls with moderate ASD: decompensated - 61 (23.74%); subcompensated - 28 (10.89%); compensated - 17 (6.61%); 1 girl (0.39%) had healthy teeth. Girls with severe ASD: decompensated - 21 (8.17%); subcompensated - 28 (10.89%); compensated - 4 (1.56%); no healthy teeth. The high intensity of caries in the decompensated form among children with moderate and severe ASD confirms the interaction between ASD severity and caries prevalence.

Significant differences in caries intensity and ASD severity were observed among boys ($p < 0.001$) and girls ($p < 0.001$).

3. Assessment of Positive and Negative Emotions (PANAS). Before dental interventions, it is necessary to assess positive and negative emotions using the PANAS scale to ensure effective treatment of children with ASD and during follow-up examinations to determine their readiness for dental procedures. Before treatment, the levels of positive and negative emotions were identical in both groups. After cavity preparation, the level of positive emotions was significantly higher in the group treated with the air-abrasion method compared to the group treated with the traditional method. High positive emotions were recorded in 90% of children in the main group and 10% in the comparison group. Low positive emotions were observed in 2.5% of the main group and 10% of the comparison group. Negative emotions increased significantly in the comparison group compared to the main group: 42.5% vs. 7.5%**,** respectively. These results demonstrate that the air-abrasion method allows painless, anesthesia-free treatment of dental caries in children with ASD, positively influencing their behavior, mood, and ensuring effective oral cavity sanitation.

4. Examination of Carious Teeth. During the examination of carious teeth, a gentle probing method was used with a graduated probe with a non-aggressive tip and the Diagnodent laser device. The following ranges were applied for fissure and approximal caries: 26 to 30. Main group: 27.5% (11) – 26; 32.5% (13) – 27; 27.5% (11) – 28; 12.5% – 29; 27.5% – 30.

Comparison group: 12.5% (5) – 26; 32.5% (13) – 27; 40% (16) – 29; 15% – 29; 12.5% – 30 Intergroup p-value (Pearson Chi-square): 0.363

5. Freeze Test for Diagnosis. Accurate diagnosis is essential for effective treatment. In cases of dental hard tissue integrity disruption due to caries, the Freeze test, based on cold temperature stimulation, was widely used. This test allows rapid identification of the affected tooth and evaluation of the nerve fibers within. The test relies on the movement of active components within the dentinal tubules, which stimulate the peripheral pulp tissue and provoke acute pain. Positive responses were obtained: the reaction to cold occurred almost immediately and subsided quickly, indicating healthy pulp tissue. These data confirm a 100% accurate response to cold and proper diagnosis of dentin caries in children with ASD.

In practical healthcare, the air-abrasion method is recommended as the most effective, gentle, painless, and atraumatic treatment, eliminating the need for anesthesia.

6. Methodological Recommendations. Developed methodological guidelines for practicing dentists and medical students improve the quality of dental care for children with ASD.

Dissertation Testing and Presentation of Results

The main results were presented at: I International Congress of Dentists of the Republic of Kazakhstan**,** Aktobe, Kazakhstan, 06–07.10.2022; IX International Scientific and Practical Conference “Priorities in Pharmacy and Dentistry: From

Theory to Practice”, Almaty, Kazakhstan, 04.11.2022; International Scientific and Practical Conference “Modern Approaches to Education, Science and Clinical Practice in Dentistry and Maxillofacial Surgery”, Samarkand, Uzbekistan, 14–15.04.2023; 1st International AsfenForum “New Generation 2023”, 05–06.06.2023

XII International Scientific and Practical Conference “Priorities in Pharmacy and Dentistry: From Theory to Practice”, dedicated to the 70th anniversary of Professor Roza Amirzhanovna Omarova, 16.11.2023; Scientific-practical conference of young scientists, KRMU, Almaty, Kazakhstan, 11.12.2023; International Scientific and Practical Conference “Leaders and Practitioners of Healthcare Organizations”, 15.11.2024; VI International Conference: “Research Results: Science and Practice in Dentistry”, Barnaul, Russia, 26.04.2024; International Scientific and Practical Conference “Aliev Readings”, 02.02.2024; International Scientific and Practical Conference “Medical and Social Aspects in the Prevention of Child Morbidity and Disability”, 27.02.2025; International Scientific and Practical Conference “Ways and Prospects of Dentistry Development in Kazakhstan: Interdisciplinary Approach in Diagnosis and Treatment of Dental Diseases”, Almaty, Kazakhstan, 27.03.2025; Master classes on healthcare education and organization of dental care for children with autism, 12.04.2024 all presentations were confirmed with certificates.

Publications and Patents

Publications: 6 scientific articles, including 1 in a Scopus-indexed journal, 3 in journals recommended by the Ministry of Education and Science of Kazakhstan, and 2 in RSCI-indexed journals. Patents: Myogymnastic device for children with ASD, № 36902 (Astana, Kazakhstan, 18.10.2024); Device for measuring carious cavity depth in children with ASD, № 9504 (Astana, Kazakhstan, 24.01.2025); Author certificate: “Oral Hygiene Algorithm for Children with ASD”, № 60652 (Astana, Kazakhstan, 09.07.2025); Author certificate: “Features of Caries Treatment Method for Children with ASD”, № 61069 (Astana, Kazakhstan, 22.07.2025).

Volume and Structure of the Dissertation

The dissertation contains 97 pages of text, including 5 chapters: introduction, literature review, materials and methods, three chapters with the results of original research, conclusions, a reference list of 175 sources (62 foreign, 110 CIS), and 5 appendices.

The work is illustrated with 21 tables and 21 figures.