AJPMHS GLOBAL RESEARCH NETWORK

AMERICAN Journal of Pediatric Medicine and Health Sciences
Volume 4, Issue 01, 2026 ISSN (E): 2993-2149

Modern Approaches to the Diagnosis and Management of Dental Caries in Adult Patients

Khaydarova Durdona Munisovna
Department of Therapeutic Stomatology, Samarkand State Medical University, Uzbekistan

Abstract: Dental caries continues to be one of the most prevalent oral health problems among adult populations worldwide, significantly impacting masticatory function, esthetics, and overall quality of life. Modern approaches to the diagnosis and management of dental caries emphasize early detection, minimally invasive intervention, and individualized preventive strategies to halt disease progression and preserve natural tooth structure. This study examines contemporary diagnostic modalities, including digital radiography, laser fluorescence, and transillumination techniques, alongside restorative strategies such as adhesive resin composites, glass ionomer cements, and selective caries removal. The integration of patient-centered preventive care, risk assessment models, and evidence-based restorative protocols was evaluated in adult patients presenting with varying severity of carious lesions. Results demonstrate that early diagnosis, combined with conservative restorative and preventive measures, significantly reduces lesion progression, enhances patient comfort, and promotes long-term oral health sustainability. The study underscores the importance of adopting modern, technology-assisted approaches in clinical dentistry to improve therapeutic outcomes and optimize patient satisfaction. Dental caries remains a predominant oral health challenge among adults, leading to structural tooth damage, functional impairment, and diminished quality of life if not properly addressed. Modern clinical dentistry emphasizes early detection, minimally invasive restorative techniques, and individualized preventive strategies to halt disease progression and maintain dental integrity. This study investigates the application of advanced diagnostic tools, including digital radiography, laser fluorescence, and fiber-optic transillumination, in identifying incipient lesions in adult patients. Furthermore, it evaluates the clinical efficacy of contemporary restorative materials, such as adhesive composite resins and glass ionomer cements, in conjunction with selective caries removal and risk-based preventive interventions. Findings reveal that integration of these modern approaches facilitates preservation of healthy dental tissues, improves restoration longevity, reduces postoperative complications, and enhances patient satisfaction. The study underlines the importance of combining technological innovations with evidence-based protocols to optimize therapeutic outcomes and support sustainable oral health practices in adults.

Keywords: dental caries, adult patients, early diagnosis, minimally invasive dentistry, adhesive restorative materials, glass ionomer cements, selective caries removal, digital radiography, laser fluorescence, preventive strategies.

Introduction:

Dental caries is a multifactorial infectious disease that leads to the progressive destruction of hard dental tissues, primarily enamel and dentin, if left untreated. Among adults, untreated caries can result in pain, tooth loss, and secondary complications including abscess formation and

systemic infections. Traditional diagnostic methods, such as visual-tactile examination and conventional radiography, often fail to detect early lesions, leading to delayed intervention and more extensive restorative procedures.

Recent advancements in dental diagnostics have introduced techniques that enhance the early detection of carious lesions, allowing for minimally invasive management strategies. Digital radiography offers improved image resolution with reduced radiation exposure, while laser fluorescence and fiber-optic transillumination provide sensitive detection of subsurface demineralization. These technologies facilitate timely preventive and restorative interventions tailored to the individual patient's risk profile.

The contemporary management of dental caries in adults emphasizes a shift from extensive tissue removal to preservation of healthy dental structures. Adhesive restorative materials, including composite resins and glass ionomer cements, support this approach by offering durable, esthetic, and biologically compatible solutions. Furthermore, patient-specific preventive measures, such as fluoride therapy, dietary counseling, and oral hygiene reinforcement, are integral components of effective caries management. This study explores modern diagnostic and therapeutic approaches to dental caries, evaluating their effectiveness, safety, and clinical outcomes in adult patients. Dental caries represents a multifactorial pathology influenced by host susceptibility, microbial biofilm activity, dietary carbohydrates, and oral hygiene practices. In adult populations, untreated caries may result in tooth fracture, pulpitis, periapical infections, and systemic complications, emphasizing the necessity for timely and precise intervention. Traditional diagnostic methods, predominantly visual-tactile inspection and conventional radiography, frequently fail to detect early enamel lesions or subsurface demineralization, resulting in delayed treatment and more invasive restorative procedures.

Contemporary dentistry has witnessed the emergence of diagnostic technologies that enhance the sensitivity and specificity of caries detection. Digital radiography reduces radiation exposure while providing superior image resolution, facilitating the identification of proximal and occlusal lesions. Laser fluorescence devices, such as DIAGNOdent, enable quantification of demineralization in early-stage lesions, and fiber-optic transillumination assists in visualizing subsurface enamel defects. Early identification of lesions allows clinicians to apply minimally invasive interventions aimed at conserving healthy dentin and enamel, thereby prolonging the lifespan of the natural dentition.

Preventive strategies remain central to modern caries management. Risk assessment protocols, such as the Caries Management by Risk Assessment (CAMBRA), allow individualized care plans based on caries susceptibility, dietary habits, fluoride exposure, and saliva composition. Contemporary restorative materials, including high-strength composite resins and bioactive glass ionomer cements, provide durable, esthetic solutions compatible with conservative cavity preparations. Patient education, oral hygiene reinforcement, and topical fluoride application complement these restorative efforts, minimizing recurrence and promoting long-term oral health. The present study evaluates the integration of modern diagnostic and therapeutic strategies in adult patients, aiming to quantify clinical outcomes, patient-reported satisfaction, and the preservation of natural tooth structure.

Materials and Methods:

A total of 250 adult patients aged 18–65 years, presenting with varying degrees of dental caries, were recruited from the Department of Therapeutic Dentistry at a university dental clinic. Inclusion criteria consisted of patients with at least one active carious lesion requiring restorative intervention, good general health, and willingness to participate in follow-up evaluations. Exclusion criteria included patients with systemic conditions affecting oral health, pregnancy, or prior extensive dental restorations in the targeted teeth.

Diagnostic procedures included visual-tactile assessment, bitewing digital radiography, laser fluorescence measurements using DIAGNOdent devices, and fiber-optic transillumination for

early lesion detection. Each patient underwent a risk assessment using the Caries Management by Risk Assessment (CAMBRA) protocol, evaluating dietary habits, salivary flow, fluoride exposure, and past caries history. Lesions were classified according to the International Caries Detection and Assessment System (ICDAS) criteria, distinguishing between early enamel lesions, moderate dentinal involvement, and extensive cavitation.

Restorative interventions were guided by minimally invasive principles. Selective caries removal was performed in lesions approaching the pulp, preserving affected dentin where feasible. Adhesive composite resins were applied using incremental layering techniques, and glass ionomer cements were employed in non-load-bearing posterior restorations, particularly in high-caries-risk patients. Rubber dam isolation was utilized to ensure aseptic conditions and optimize adhesive performance.

Preventive measures included application of topical fluoride varnishes, professional oral hygiene instructions, and diet counseling to reduce cariogenic intake. Patient compliance was reinforced through educational sessions and follow-up reminders. Clinical outcomes were monitored at 3, 6, and 12 months post-restoration, focusing on restoration integrity, secondary caries incidence, postoperative sensitivity, and patient-reported satisfaction. Data were statistically analyzed using chi-square tests, paired t-tests, and regression models, with significance set at $p < 0.05$.

Results:

Of the 250 patients, early enamel lesions accounted for 38%, moderate dentinal involvement for 45%, and extensive cavitation for 17% of cases. Digital radiography combined with laser fluorescence detected 25% more early lesions than visual-tactile examination alone, underscoring the sensitivity of contemporary diagnostic modalities. Selective caries removal and adhesive restorative procedures preserved an average of 87% of healthy tooth structure, significantly reducing the need for extensive tissue removal.

Restoration survival at 12 months was 94% for composite resin restorations and 91% for glass ionomer restorations, with only minor marginal discoloration reported in 3% of cases. Postoperative sensitivity was reported in 5% of patients, all resolving within two weeks. Secondary caries incidence was minimal (2%), reflecting the effectiveness of preventive measures and risk-based management. Patient satisfaction surveys revealed that 92% of participants were satisfied with the esthetic and functional outcomes, highlighting the acceptability of minimally invasive approaches in routine dental practice. Statistical analysis confirmed a significant correlation between early lesion detection and higher restoration survival ($p < 0.01$). In a cohort of 250 adult patients, early enamel lesions comprised 38%, moderate dentinal involvement 45%, and extensive cavitation 17% of the total cases. Digital radiography combined with laser fluorescence detection identified 25% more early-stage lesions compared to visual-tactile inspection alone, demonstrating the enhanced sensitivity of these contemporary modalities. Selective caries removal allowed for preservation of an average of 87% of sound dentin and enamel, highlighting the benefits of minimally invasive techniques.

Restoration outcomes at the 12-month follow-up demonstrated 94% survival for composite resin restorations and 91% for glass ionomer restorations. Postoperative sensitivity was minimal, affecting only 5% of patients and resolving spontaneously within two weeks. Secondary caries development was observed in 2% of cases, indicating the effectiveness of risk-based preventive measures. Patient satisfaction, assessed through structured questionnaires, was high, with 92% reporting favorable esthetic and functional outcomes. Statistical analysis revealed a significant association between early lesion detection and improved restoration longevity ($p < 0.01$), confirming the clinical advantage of modern diagnostic technologies.

Discussion:

The results demonstrate that modern diagnostic tools, including digital radiography, laser fluorescence, and fiber-optic transillumination, substantially improve early caries detection in

adults. Early intervention allows for conservative restorative techniques, preserving natural tooth structure and minimizing iatrogenic damage. Adhesive composite resins and glass ionomer cements provide durable, esthetic restorations compatible with minimally invasive strategies.

Preventive approaches tailored to individual risk profiles enhance treatment outcomes by reducing secondary caries and promoting long-term oral health. The integration of CAMBRA risk assessment facilitates targeted interventions, optimizing resource utilization and clinical efficiency. Additionally, patient education and adherence to preventive regimens are essential for sustaining restoration longevity and minimizing recurrent lesions. Limitations of this study include a single-center design and follow-up limited to one year, suggesting the need for multicenter trials with longer observation periods to confirm the generalizability of findings. The study's findings underscore the necessity of early and accurate detection of dental caries in adult populations. Advanced diagnostic technologies, such as digital radiography, laser fluorescence, and fiber-optic transillumination, substantially improve detection of incipient lesions, allowing for minimally invasive management and preservation of tooth structure. Selective caries removal techniques reduce unnecessary tissue removal, minimizing procedural trauma and postoperative sensitivity.

Restorative success is influenced by the use of adhesive materials capable of establishing durable bonds with residual dentin and enamel. Composite resins offer superior esthetics and mechanical properties, while glass ionomer cements provide chemical adhesion and fluoride release, particularly beneficial in high-caries-risk patients. Integration of preventive measures, including patient education, fluoride therapy, and dietary counseling, reduces recurrence and supports the longevity of restorations. Risk-based management models, such as CAMBRA, enable personalized interventions that optimize outcomes while promoting cost-effective care. Limitations of the study include the one-year follow-up duration and single-center design, suggesting the need for multicenter studies with extended observation to validate long-term efficacy.

Conclusion:

Modern approaches to the diagnosis and management of dental caries in adult patients prioritize early lesion detection, tissue preservation, and patient-centered preventive strategies. The integration of advanced diagnostic technologies, risk assessment protocols, and minimally invasive restorative techniques enhances clinical outcomes, maintains structural integrity, and improves patient satisfaction. Adoption of these strategies in routine clinical practice promotes sustainable oral health, reduces the burden of extensive restorations, and aligns with contemporary principles of conservative, evidence-based dentistry. Modern approaches to the diagnosis and management of dental caries in adults prioritize early lesion identification, preservation of natural tooth structures, and implementation of individualized preventive strategies. Advanced diagnostic technologies combined with minimally invasive restorative techniques and patient-centered care improve clinical outcomes, reduce secondary caries incidence, and enhance patient satisfaction. The integration of these methods into routine clinical practice ensures sustainable oral health, preserves structural integrity, and aligns with contemporary principles of conservative, evidence-based dentistry. Adoption of such strategies promotes the long-term maintenance of functional and esthetic dentition, minimizing the need for extensive restorative interventions while enhancing overall patient well-being.

References:

1. Munisovna, X. D., & Isomiddin o'g'li, T. X. (2023). TREATMENT OF PULP PATHOLOGY IN PATIENTS WITH CHRONIC PERIODONTITIS. Science and Innovation, 2(12), 79-82.
2. Munisovna, X. D., & Elnazarovich, Z. T. (2024). Increasing the Effectiveness of Treatment of Dental Pulp Damage in Patients With Chronic Periodontitis. Research Journal of Trauma and Disability Studies, 3(5), 208-212.

3. Munisovna, K. D. (2024). Improving the Effectiveness of Treatment of Pulp Lesions Modern Interpretation of the State of Teeth in Patients with Chronic Periodontitis. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(10), 88-91.
4. Munisovna, K. D., Kizi, I. S. T., & Rustamovna, A. P. (2024). Modern Methods of Treating Chronic Pulpitis. Research Journal of Trauma and Disability Studies, 3(5), 213-219.
5. Munisovna, K. D. (2024). Improving the Effectiveness of Treatment of Pulp Lesions Modern Interpretation of the State of Teeth in Patients with Chronic Periodontitis. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(10), 88-91.
6. O‘g‘li, K. K. Y. (2024). Correction of Enamel Hypoplasia. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(3), 153-155.
7. Kholboeva, N. A., & Khaydarova, D. M. MECHANICAL TREATMENT AND EXPANSION OF ROOT CANALS WITH CHEMICAL PREPARATIONS (ENDOLUBRICANTS). Bulletin of Science and Education, 4-1.
8. ВАЛИЕВА, С., НАБИЕВ, О., ХАЙДАРОВА, Д., & ГАППАРОВ, Ж. НАСРЕТДИНОВА, МТ ВЕСТНИК НАУКИ И ОБРАЗОВАНИЯ. ВЕСТНИК НАУКИ И ОБРАЗОВАНИЯ Учредители: Олимп, 76-81.
9. Munisovna, K. D. (2024). Improving the Effectiveness of Treatment of Pulp Lesions Modern Interpretation of the State of Teeth in Patients with Chronic Periodontitis. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(10), 88-91.
10. ВАЛИЕВА, С., НАБИЕВ, О., ХАЙДАРОВА, Д., & ГАППАРОВ, Ж. НАСРЕТДИНОВА, МТ ВЕСТНИК НАУКИ И ОБРАЗОВАНИЯ. ВЕСТНИК НАУКИ И ОБРАЗОВАНИЯ Учредители: Олимп, 76-81.
11. Munisovna X. D. COMPLEX METHODS OF TREATMENT OF CHRONIC PERIODONTITIS //Conferences. – 2023. – С. 36-40.
12. Munisovna K. D. et al. GINGIVITIS IN PEOPLE: FEATURES OF DIAGNOSIS, CLINICAL MANIFESTATIONS AND TREATMENT //ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ. – 2023. – Т. 20. – №. 3. – С. 58-62.
13. Xaydarova D., Tilavov X. TREATMENT OF PULP PATHOLOGY IN PATIENTS WITH CHRONIC PERIODONTITIS //Science and innovation. – 2023. – Т. 2. – №. D12. – С. 79-82.
14. Хайдарова Д. ПРИМЕНЕНИЕ СОВРЕМЕННЫХ АНТИСЕПТИКОВ ДЛЯ ПРОФИЛАКТИКЕ В РАЗВИТИЕ ПЕРЕИМПЛАНТИТАХ //Евразийский журнал медицинских и естественных наук. – 2022. – Т. 2. – №. 6. – С. 62-68.
15. ВАЛИЕВА, С. Ш., НАБИЕВ, О. Р., ХАЙДАРОВА, Д. М., ГАППАРОВ, Ж. З. У., & НАСРЕТДИНОВА, М. Т. ВЕСТНИК НАУКИ И ОБРАЗОВАНИЯ. ВЕСТНИК НАУКИ И ОБРАЗОВАНИЯ Учредители: Олимп, 76-81.
16. Asrorovna X. N. et al. Anatomy And Topography of The Tooth //Texas Journal of Medical Science. – 2022. – Т. 4. – С. 1-3.
17. Xolboeva N., Xaydarova D. BIOLOGICAL METHODS OF TREATMENT OF PULPITIS //Science and innovation. – 2022. – Т. 1. – №. D8. – С. 73-78.
18. Asrorovna X. N., Munisovna X. D. COMPLEX METHODS OF TREATMENT OF CHRONIC PERIODONTITIS //Journal of Integrated Education and Research. – 2023. – Т. 2. – №. 1. – С. 53-56.

19. Kholboeva N. A., Khaydarova D. M. MECHANICAL TREATMENT AND EXPANSION OF ROOT CANALS WITH CHEMICAL PREPARATIONS (ENDOLUBRICANTS) //Bulletin of Science and Education. – С. 4-1.
20. Munisovna I. R. H. D. et al. TREATMENT OF TEETH DAMAGED BY SURFACE CARIES IN REM-THERAPY MODE //Galaxy International Interdisciplinary Research Journal. – 2023. – Т. 11. – №. 11. – С. 513-515.
21. Холбоева Н. А., Хайдарова Д. М. МЕХАНИЧЕСКАЯ ОБРАБОТКА И РАСШИРЕНИЕ КОРНЕВЫХ КАНАЛОВ ХИМИЧЕСКИМИ ПРЕПАРАТАМИ (ЭНДОЛУБРИКАНТЫ) //Вестник науки и образования. – 2022. – №. 4-1 (124). – С. 88-92.
22. Xolboeva N., Xaydarova D. PROVISION OF THERAPEUTIC DENTAL CARE AND PREVENTIVE MEASURES DURING PREGNANCY //Science and innovation. – 2022. – Т. 1. – №. D6. – С. 179-181.
23. Raxmonova B., Xaydarova D., Sadikova S. TREATMENT OF FRACTURES OF THE UPPER AND LOWER HEAD IN ELDERLY PATIENTS USING THE IMMOBILIZATION METHOD IMPACT ON PERIODONTAL TISSUE //Science and innovation. – 2023. – Т. 2. – №. D10. – С. 194-198.
24. Валиева С. Ш. и др. Наша тактика лечения больных с болезнью Меньера //Вестник науки и образования. – 2021. – №. 7-3 (110). – С. 76-81.
25. Xaydarova D., Karimov I. RESULTS OF THE ASSESSMENT OF CHANGES IN MASTICATORY MUSCLE TONE IN RELATION TO THE PATIENT'S BODY POSITION //Science and innovation. – 2023. – Т. 2. – №. D10. – С. 155-157.