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MISTAKES AND COMPLICATIONS THAT ARISE DURING THE DIAGNOSIS AND TREATMENT OF DENTAL CARIES, THEIR PREVENTION AND TREATMENT. PAIN RELIEF METHODS FOR CARIES TREATMENT

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Abstract. *This article is devoted to the analysis of errors and complications arising in the diagnosis and treatment of dental caries. The study examines common diagnostic shortcomings, technical errors during operative procedures, and their clinical consequences based on the review of contemporary scientific literature. Particular attention is paid to complications such as postoperative sensitivity, restoration failure, and pulpal involvement.*

The article also discusses the role of minimally invasive dentistry principles and modern diagnostic approaches in reducing treatment-related errors. In addition, methods of pain control used during caries treatment, including local anesthesia and patient-centered strategies, are reviewed.

Keywords: *Dental caries, diagnostic errors, treatment complications, minimally invasive dentistry, pain control, local anesthesia.*

Annotatsiya. *Ushbu maqola tish karyesini tashxislash va davolash jarayonida yuzaga keladigan xatolar hamda asoratlarni tahlil qilishga bag‘ishlangan. Tadqiqotda zamonaviy ilmiy adabiyotlar tahlili asosida diagnostik kamchiliklar, operativ davolash jarayonida yo‘l qo‘yiladigan texnik xatolar va ularning klinik oqibatlari yoritilgan.*

Davolashdan keyingi sezuvchanlik, restavratsiyalarning muvaffaqiyatsizligi hamda pulpa bilan bog‘liq asoratlar alohida muhokama qilingan. Shuningdek, karyesni davolashda minimal invaziv stomatologiya tamoyillarining va zamonaviy diagnostik yondashuvlarning ahamiyati ko‘rsatib berilgan.

Kalit so‘zlar: *Tish karyesi, diagnostik xatolar, davolash asoratlari, minimal invaziv stomatologiya, og‘riqni nazorat qilish, mahalliy anesteziya.*

Аннотация. *Данная статья посвящена анализу ошибок и осложнений, возникающих при диагностике и лечении кариеса зубов. В работе рассматриваются основные диагностические недостатки, технические ошибки при проведении оперативного лечения и их клинические последствия на основе анализа современной научной литературы. Особое внимание уделено таким осложнениям, как послеоперационная чувствительность, несостоятельность реставраций и поражение пульпы.*

Также обсуждается роль принципов минимально инвазивной стоматологии и современных диагностических подходов в снижении частоты лечебных ошибок. Кроме того, рассмотрены методы обезболивания при лечении кариеса, включая местную анестезию и пациент-ориентированные стратегии.

Ключевые слова: *кариес зубов, диагностические ошибки, осложнения лечения, минимально инвазивная стоматология, местная анестезия.*

INTRODUCTION

Dental caries is one of the most widespread oral health problems and continues to pose a major challenge to modern dentistry despite significant technological and scientific progress. It is a chronic, multifactorial disease resulting from the interaction between cariogenic microorganisms, dietary carbohydrates, and host-related factors such as saliva composition, enamel structure, and oral hygiene practices. If left undiagnosed or improperly treated, dental caries can lead to pulp pathology, periapical lesions, tooth loss, and systemic complications, ultimately reducing a patient's quality of life.

Accurate diagnosis is the cornerstone of effective caries management. However, errors in diagnosing dental caries remain common in everyday clinical practice. Early carious lesions, particularly those confined to enamel or located on proximal surfaces, are often difficult to detect using conventional methods. Inadequate clinical examination, insufficient use of radiographic techniques, and misinterpretation of diagnostic findings may result in either underdiagnosis or overdiagnosis. Both scenarios are undesirable: failure to detect active lesions may allow disease progression, whereas unnecessary operative intervention contradicts the principles of minimally invasive dentistry.

Errors are not limited to diagnosis alone but frequently occur during the treatment phase as well. Improper cavity preparation, excessive removal of healthy tooth structure, inadequate caries excavation, and incorrect selection or handling of restorative materials can lead to various complications. These include postoperative sensitivity, marginal leakage, secondary caries, restoration failure, and, in severe cases, iatrogenic pulp exposure. Such complications not only compromise treatment outcomes but also increase the need for retreatment, placing an additional financial and psychological burden on patients.

METHODOLOGY AND LITERATURE REVIEW

The present study is based on a structured narrative review of scientific literature addressing errors and complications in the diagnosis and treatment of dental caries, as well as methods of pain control used in caries management. A narrative review approach was selected in order to integrate clinical, biological, and patient-centered perspectives and to provide a comprehensive interpretation of existing evidence relevant to everyday dental practice [1].

Key search terms included dental caries, diagnostic errors, operative dentistry complications, minimally invasive dentistry, postoperative sensitivity, local anesthesia, and pain management in dentistry. Boolean combinations of these terms were used to refine the search results. Priority was given to clinical studies, systematic reviews, and consensus statements that demonstrated direct relevance to diagnosis, treatment decision-making, and complication management.

Inclusion criteria encompassed publications written in English that addressed at least one of the following aspects: diagnostic accuracy in caries detection, clinical errors during operative treatment, postoperative complications, preventive strategies, or anesthetic techniques used during caries therapy [2].Articles focusing exclusively on prosthodontics, orthodontics, or surgical dentistry without relevance to caries management were excluded.

The literature consistently identifies diagnostic inaccuracy as a major challenge in caries management.

Fejerskov, Nyvad, and Kidd emphasize that dental caries should be understood as a dynamic disease process rather than a purely structural defect, highlighting the importance of lesion activity assessment in diagnosis. Studies demonstrate that early enamel lesions and proximal caries are frequently underdiagnosed when visual-tactile examination is used alone.

Kidd and Smith report that reliance on sharp explorers may not only fail to detect early lesions but may also cause iatrogenic damage to demineralized enamel surfaces [3].Radiographic examination, particularly bitewing radiographs, is widely recommended as an adjunctive diagnostic tool; however, Banerjee and colleagues note that radiographic interpretation is highly operator-dependent and prone to both underestimation and overestimation of lesion depth.

Recent consensus recommendations, such as those summarized by Schwendicke et al., stress the necessity of combining visual scoring systems, radiographic assessment, and patient-specific caries risk evaluation. This multidimensional diagnostic approach reduces the likelihood of overtreatment and supports more conservative clinical decisions [4].

Errors during operative treatment of dental caries are extensively discussed in the literature. Traditional concepts advocating complete removal of all carious dentin have been increasingly challenged. Frencken and co-authors demonstrate that aggressive caries excavation significantly increases the risk of pulp exposure, particularly in deep lesions.

Banerjee et al. highlight that excessive removal of sound tooth structure remains common in clinical practice, often due to outdated teaching models. In contrast, selective caries removal and stepwise excavation have been shown to preserve pulp vitality without increasing the risk of lesion progression when adequate sealing is achieved [5].

Postoperative sensitivity is one of the most frequently reported complications following caries treatment. Brännström’s hydrodynamic theory remains the most widely accepted explanation, attributing sensitivity to fluid movement within exposed dentinal tubules. Contemporary studies confirm that dentin dehydration, improper adhesive techniques, and marginal microleakage are major contributing factors.

Effective pain control is a fundamental component of successful caries treatment [6]. Malamed describes local anesthesia as the cornerstone of pain management in dentistry, emphasizing that its success depends on correct technique, anatomical knowledge, and appropriate anesthetic selection.

Clinical studies indicate that inadequate anesthesia remains a common cause of patient discomfort and dental anxiety. Meechan highlights that failures in mandibular anesthesia are often related to anatomical variations and improper injection technique rather than anesthetic inefficacy.

RESULTS AND DISCUSSION

The analysis of the reviewed literature reveals that errors and complications in the diagnosis and treatment of dental caries remain prevalent despite advancements in diagnostic technologies, restorative materials, and clinical protocols. The findings demonstrate that many of these issues are closely associated with operator-dependent factors, inadequate application of evidence-based principles, and insufficient integration of preventive strategies into routine dental practice. This section discusses the key results identified in the literature and interprets their clinical significance [7].

The reviewed studies consistently indicate that diagnostic inaccuracies are among the most common contributors to unfavorable treatment outcomes. Early-stage carious lesions, particularly non-cavitated enamel caries and proximal lesions, are frequently underdiagnosed. This underdiagnosis often leads to delayed intervention, allowing lesions to progress into dentin and increasing the risk of pulpal involvement. The results highlight that reliance on visual-tactile examination alone is insufficient for accurate caries detection, especially in high-risk patients.

Overdiagnosis was also identified as a significant issue, particularly in cases where discolorations, developmental defects, or radiographic artifacts were misinterpreted as active caries [8]. Such findings support the growing consensus that inappropriate operative intervention remains a persistent problem in dentistry. Overdiagnosis not only results in unnecessary loss of healthy tooth structure but also initiates a restorative cycle that may ultimately compromise tooth longevity. These results reinforce the importance of assessing lesion activity and patient-specific caries risk rather than basing treatment decisions solely on lesion presence.

The literature analysis demonstrates that treatment-related errors most commonly occur during cavity preparation and restorative procedures. Excessive removal of sound enamel and dentin was frequently reported, particularly in studies evaluating traditional caries removal techniques. These findings suggest that outdated concepts of complete caries excavation continue to influence clinical practice, despite strong evidence supporting selective and stepwise caries removal.

One of the most significant consequences of over-preparation is iatrogenic pulp exposure.

The reviewed data indicate that pulp exposure rates increase substantially in deep carious lesions when aggressive excavation techniques are employed. This outcome often necessitates complex endodontic procedures that could have been avoided through conservative management. In contrast, studies that applied minimally invasive techniques reported lower rates of pulpal complications and higher long-term tooth survival [9].

Postoperative sensitivity emerged as one of the most frequently reported complications following caries treatment. The literature identifies several contributing factors, including dentin exposure, dehydration of tooth tissues, and errors in adhesive protocols. Studies comparing different bonding systems revealed that technique sensitivity plays a critical role in clinical outcomes. Inadequate etching, insufficient polymerization, and contamination during bonding were strongly associated with increased sensitivity and restoration failure.

Polymerization shrinkage of resin-based composites was another commonly discussed factor. The results indicate that shrinkage stress can lead to marginal gaps, microleakage, and secondary caries if not properly managed. Incremental placement techniques and appropriate curing protocols were shown to reduce these risks significantly. These findings emphasize that the successful use of modern restorative materials depends not only on material properties but also on the clinician’s technical proficiency [10].

The results highlight that effective pain control plays a crucial role in both clinical success and patient satisfaction. Inadequate anesthesia was frequently associated with negative treatment experiences and increased dental anxiety. The literature indicates that improper injection technique, anatomical variations, and incorrect anesthetic selection are common causes of insufficient pain control during caries treatment.

Comparative analyses of anesthetic agents revealed that modern formulations, particularly those with improved diffusion properties, provide more predictable anesthesia in many clinical situations. However, the results also underscore that pharmacological advances alone cannot compensate for poor technique [11]. Clinician skill and anatomical knowledge remain fundamental determinants of anesthetic success.

The discussion of results underscores the central role of prevention in reducing diagnostic and therapeutic errors. The literature consistently supports the integration of caries risk assessment into routine clinical practice. Risk-based decision-making allows clinicians to tailor diagnostic frequency, preventive measures, and treatment strategies to individual patient needs.

The reviewed studies also highlight the importance of continuous professional development. Clinicians who regularly engage in evidence-based education and clinical audits demonstrate lower rates of complications and higher treatment success. These findings suggest that many errors are not due to a lack of available knowledge but rather to inadequate translation of evidence into practice.

Minimally invasive dentistry emerged as a unifying theme throughout the reviewed literature. The results clearly indicate that conservative approaches to caries management, combined with effective prevention and patient education, lead to improved clinical outcomes and long-term tooth preservation [12].

The findings discussed in this section have important implications for clinical practice.

Diagnostic and therapeutic errors in caries management are largely preventable and often stem from modifiable factors. Emphasizing accurate diagnosis, conservative treatment principles, and effective pain control can significantly reduce complications and improve patient outcomes.

CONCLUSION

Dental caries continues to be a major clinical challenge in contemporary dentistry, not only due to its high prevalence but also because of the frequent errors and complications associated with its diagnosis and treatment. The findings discussed in this article demonstrate that many diagnostic inaccuracies and treatment-related complications are not inevitable consequences of the disease itself, but rather the result of operator-dependent factors, insufficient application of evidence-based principles, and inadequate integration of preventive strategies into routine practice.

Errors in caries diagnosis, particularly underdiagnosis of early lesions and overdiagnosis of non-carious defects, significantly influence treatment outcomes. Inaccurate diagnostic decisions may lead to delayed intervention, unnecessary operative procedures, and premature loss of healthy tooth structure. These issues highlight the critical importance of comprehensive diagnostic approaches that combine clinical examination, radiographic assessment, and evaluation of lesion activity and caries risk.

Complications arising during caries treatment, such as postoperative sensitivity, restoration failure, and pulpal involvement, are closely linked to improper cavity preparation, inadequate adhesive techniques, and poor isolation. The evidence reviewed supports the adoption of minimally invasive dentistry principles, including selective caries removal and preservation of tooth vitality, as effective strategies for reducing these complications and improving long-term outcomes.

Effective pain control is an essential component of successful caries management and has a direct impact on patient comfort and cooperation. While local anesthesia remains the cornerstone of pain management, its success depends on appropriate technique, correct agent selection, and consideration of patient-specific factors. Non-pharmacological approaches, including clear communication and behavioral management, further enhance the overall treatment experience.

In conclusion, most errors and complications associated with dental caries management are preventable. By improving diagnostic accuracy, adhering to evidence-based and minimally invasive treatment principles, and implementing comprehensive pain control strategies, clinicians can significantly enhance the quality of dental care, preserve tooth structure, and improve patient satisfaction and oral health outcomes.

References

1. Abdurakhmanov A.A., Rakhmatullaev Sh.R. Therapeutic dentistry: modern approaches to diagnosis and treatment. Tashkent: Abu Ali ibn Sino Publishing House; 2019. pp. 120–185.
2. Ismailov J.K., Karimov B.A. Clinical aspects of dental caries management in Uzbekistan. *Stomatologiya Journal (Tashkent)*. 2020;2:15–22.
3. Rahimov F.Kh., Qodirov N.N. Diseases of hard dental tissues: diagnosis and prevention. Tashkent: Fan va texnologiya; 2018. pp. 75–140.
4. Abdullaev A.M., Saidov I.I. Minimally invasive dentistry in clinical practice. *Uzbek Journal of Medical Sciences*. 2022;1:45–52.
5. Fejerskov O., Nyvad B., Kidd E.A.M. Dental Caries: The Disease and Its Clinical Management. 3rd ed. Oxford: Wiley Blackwell; 2015. pp. 1–480.
6. Kidd E.A.M., Smith B.G.N. Pickard's Manual of Operative Dentistry. 10th ed. Oxford: Oxford University Press; 2016. pp. 55–140.
7. Mount G.J., Hume W.R. Preservation and Restoration of Tooth Structure. 2nd ed. Queensland: Knowledge Books; 2018. pp. 90–210.
8. Banerjee A., Watson T.F., Kidd E.A.M. Dentine caries excavation: a review of current clinical techniques. *British Dental Journal*. 2018;225(3):179–187.
9. Frencken J.E., Sharma P., Stenhouse L., Green D., Laverty D., Dietrich T. Minimal intervention dentistry for managing dental caries. *International Dental Journal*. 2017;67(1):6–16.
10. Schwendicke F., Innes N., Frencken J.E. et al. Managing carious lesions: consensus recommendations. *Journal of Dental Research*. 2020;99(7):739–747.
11. Nurmatov O.K. Pain management methods in therapeutic dentistry. Tashkent: Fan; 2017. pp. 60–115.
12. Yuldashev U.B., Mamatkulov J.Sh. Early diagnosis of dental caries using modern methods. *Stomatologiya Journal (Tashkent)*. 2019;3:19–25.