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ERRORS AND COMPLICATIONS ARISING IN THE DIAGNOSIS AND TREATMENT OF DENTAL CARIES. THEIR PREVENTION AND TREATMENT. METHODS OF PAIN RELIEF IN CARIES TREATMENT

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Abstract

This article analyzes the main errors and complications that occur during the diagnosis and treatment of dental caries. The causes of incorrect diagnosis at different stages of the carious process, violations of treatment protocols, and mistakes in the selection and application of restorative materials are discussed. Special attention is paid to the development of complications such as pulpitis, periodontitis, secondary caries, and pain syndromes. The article also reviews preventive measures, modern approaches to the management of complications, and contemporary local and general anesthesia methods used in caries treatment. The findings contribute to improving the quality of dental care and enhancing patient safety in clinical practice.

Keywords

dental caries, diagnostic errors, treatment complications, secondary caries, pulpitis, periodontitis, anesthesia methods, dentistry

Аннотация

В данной статье рассматриваются основные ошибки и осложнения, возникающие при диагностике и лечении кариеса зубов. Проанализированы причины неправильной диагностики на различных стадиях кариозного процесса, нарушения лечебных протоколов, а также ошибки при выборе и применении пломбировочных материалов. Особое внимание уделено развитию таких осложнений, как пульпит, периодонтит, вторичный кариес и болевой синдром. В статье также освещены меры профилактики и современные методы лечения осложнений, а также методы местного и общего обезболивания, применяемые при лечении кариеса. Представленные данные направлены на повышение качества стоматологической помощи и снижение риска осложнений в клинической практике.

Ключевые слова

кариес зубов, диагностические ошибки, осложнения лечения, вторичный кариес, пульпит, периодонтит, методы обезболивания, стоматология

Annotatsiya

Mazkur maqolada tish kariyesini diagnostika qilish va davolash jarayonida uchraydigan asosiy xatolar hamda asoratlar batafsil tahlil qilinadi. Kariyesni erta va kech bosqichlarda

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noto‘g‘ri aniqlash, davolash texnologiyalariga rioya qilmaslik, plomba materiallarini noto‘g‘ri tanlash va qo‘llash kabi omillar asoratlar rivojlanishiga olib kelishi mumkin. Shuningdek, pulpitis, periodontit, ikkilamchi kariyes va og‘riqli holatlarning yuzaga kelish sabablari yoritib beriladi. Maqolada ushbu xatolar va asoratlarning oldini olish choralari, ularni samarali davolash usullari hamda kariyesni davolashda qo‘llaniladigan zamonaviy mahalliy va umumiy og‘riqsizlantirish usullari muhokama qilinadi. Tadqiqot natijalari stomatologik amaliyotda davolash sifatini oshirish va bemorlar xavfsizligini ta’minlashga xizmat qiladi.

Kalit so‘zlar

tish kariyesi, diagnostik xatolar, davolash asoratlari, ikkilamchi kariyes, pulpitis, periodontit, og‘riqsizlantirish usullari, stomatologiya

Introduction

Dental caries remains one of the most common dental pathologies worldwide, despite significant progress in prevention, diagnosis, and treatment of dental hard tissues. According to the World Health Organization, caries affects up to 90% of the adult population and a significant proportion of children, demonstrating its high social and medical significance. The relevance of the problem is due not only to the widespread prevalence of the disease but also to the high risk of complications due to delayed or incorrect diagnosis and treatment. Modern dentistry offers a wide range of diagnostic methods and treatment technologies that allow for the effective detection and treatment of carious lesions at various stages. However, in practice, diagnostic and tactical errors often occur due to insufficient assessment of the clinical picture, ignoring additional examination methods, and failure to adhere to treatment standards and protocols. These errors can lead to complications such as pulpitis, periodontitis, secondary caries, increased tooth sensitivity, and severe pain, significantly reducing patients' quality of life and complicating subsequent treatment. Misinterpretation of the caries stage is particularly important in the development of complications. Superficial and early stages of caries may be underestimated, leading to disease progression, while overly aggressive interventions at early stages can cause trauma to the pulp and surrounding tissues. Furthermore, errors in the selection of filling materials, improper cavity preparation techniques, inadequate isolation of the working area, and failure to adhere to adhesive protocols play a significant role. Adequate pain relief is an equally important aspect of caries treatment. Pain during dental procedures is one of the main reasons for patient anxiety and refusal of treatment. Errors in the selection of anesthesia methods, improper technique, or individual patient characteristics can lead to inadequate pain relief, complications, and a negative attitude toward dental care. Therefore, special attention is paid to studying modern methods of local and general anesthesia, their indications, contraindications, and potential side effects. Preventing diagnostic and treatment errors is key to improving the effectiveness of dental care. This includes continuous professional development for physicians, the implementation of clinical guidelines, the use of modern diagnostic technologies, and an individualized approach to each patient, taking into account their medical status and dental history. A comprehensive analysis of errors and complications allows for the development of effective strategies for their prevention and timely correction. Therefore, studying errors and complications that arise during the diagnosis and treatment of dental caries, as well as methods for their prevention and treatment, represents an important scientific and practical task in modern dentistry. A systematic approach to the problem is particularly important, including the refinement of diagnostic algorithms, optimization of treatment protocols, and the rational selection of pain relief methods. This not only improves the quality of dental care but also reduces the incidence of complications, improves treatment prognosis, and increases patient satisfaction.

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Main Part

Diagnosis of dental caries is key to planning and implementing effective treatment. Despite the availability of modern diagnostic methods, diagnostic errors remain one of the most common causes of unfavorable treatment outcomes. These errors can be due to both subjective factors related to the dentist's experience and qualifications, as well as objective factors, including the clinical course of the caries process and limited diagnostic capabilities. One of the most common errors is underestimating the early stages of caries, especially the white spot stage. Visually, such lesions can be subtle, and the lack of obvious symptoms often leads to their ignorance. As a result, the process progresses and progresses to deeper stages requiring invasive intervention. At the same time, overdiagnosis of caries can lead to unnecessary preparation of intact tooth tissue, which violates the principles of minimally invasive dentistry. A significant role in diagnostic errors is played by the inadequate use of additional diagnostic methods, such as radiography, transillumination, laser fluorescence, and electroodontometry. Failure to perform radiographic examination when occult or approximal caries is suspected can lead to missed lesions, especially in areas difficult to visually access. Furthermore, misinterpretation of radiographic data can also lead to diagnostic inaccuracies. Misdiagnosis of the differential diagnosis between deep caries and early stages of pulpitis presents a particular clinical challenge. Insufficient analysis of patient complaints, disease history, and functional test results can lead to an incorrect diagnosis and, consequently, to inappropriate treatment. Errors made during caries treatment are largely the result of incorrect diagnosis, but they often occur even with a correct diagnosis. The most common treatment errors include improper cavity preparation techniques, incorrect selection of filling material, and failure to adhere to treatment stages and adhesive protocols. Excessive or, conversely, insufficient removal of diseased tooth tissue is a common cause of complications. Insufficient excavation of infected dentin promotes the persistence of microflora and the development of secondary caries, while over-excavation can lead to exposure of the cavity and pulp injury. The risk of such errors is particularly high when treating deep caries. Failure to properly isolate the working area, particularly failure to use a rubber dam, significantly reduces the quality of restoration. Saliva or blood contact with adhesive surfaces reduces the bond strength of the filling material to the tooth tissue, which subsequently contributes to microleakage and the development of secondary caries. Errors in the selection of filling materials also have a significant impact on treatment outcome. Inappropriate physical and mechanical properties of the material for the clinical situation, as well as improper placement and polymerization techniques for composites, can lead to postoperative sensitivity, marginal permeability, and premature restoration failure. Complications after dental caries treatment can occur both early and late. The most common complications include pulpitis, periodontitis, secondary caries, hyperesthesia of hard dental tissues, and chronic pain. Pulpitis most often develops as a result of thermal or mechanical trauma to the pulp during preparation, as well as microleakage under the filling. Failure to adhere to gentle preparation principles, insufficient cooling, and the absence of therapeutic liners for deep caries significantly increase the risk of this complication. Periodontitis can result from the spread of inflammation beyond the dental cavity or from root canal infection due to untimely pulpitis treatment. This complication is characterized by more complex and lengthy treatment and often leads to tooth loss. Secondary caries develops at the junction of the filling and the hard tissues of the tooth and is one of the most common late complications. Its occurrence is associated with a loss of seal in the restoration, errors in adhesive technique, and poor oral hygiene. Preventing diagnostic and treatment errors is a key focus in modern dentistry. This is based on adherence to clinical guidelines, standardization of treatment protocols, and continuous professional development of the dentist. A comprehensive diagnostic approach, including a thorough clinical examination, medical history collection, and the use of additional diagnostic methods, plays a key role. The use of modern imaging technologies improves diagnostic accuracy and reduces the likelihood of

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errors. Adherence to the principles of minimally invasive treatment, adequate isolation of the working field, rational selection of filling materials, and strict adherence to adhesive protocols significantly reduce the risk of complications. Equally important is informing patients about the need for oral hygiene and regular preventive examinations. Effective pain relief is an integral part of dental caries treatment and plays a vital role in ensuring patient comfort and the quality of treatment. Various anesthesia methods are used in dental practice, the choice of which depends on the extent of the procedure, the location of the lesion, and the individual characteristics of the patient. Local infiltration and conduction anesthesia using modern anesthetics based on articaine, lidocaine, and mepivacaine are the most widely used. Proper selection of the drug, concentration, and administration technique ensures reliable and safe pain relief. In some cases, especially in patients with severe dental phobia, sedation or general anesthesia may be used. However, these methods require strict adherence to the indications and patient monitoring. Errors in anesthesia administration, such as incorrect choice of method, insufficient drug dosage, or improper administration technique, can lead to incomplete pain relief and complications. Therefore, knowledge of the anatomical features, pharmacological properties of anesthetics, and a personalized approach to the patient are essential for successful treatment.

Empirical Analysis

To study the frequency of diagnostic and treatment errors, as well as complications arising during dental caries treatment, an empirical analysis of clinical data from patients seeking dental care in general dental departments was conducted. The study was retrospective and partially prospective in nature and was based on an analysis of medical records, clinical examinations, and the results of additional diagnostic methods. The study included data from 180 patients aged 18 to 60 years who were treated for caries of various locations and stages. All patients were divided into groups based on the depth of the carious lesion: superficial and moderate caries (Group I) and deep caries (Group II). The evaluation criteria included the accuracy of the initial diagnosis, adherence to treatment protocols, the incidence of complications, and the effectiveness of pain relief methods. The analysis revealed that diagnostic errors were identified in 27.8% of patients. These errors were most frequently observed in early and latent forms of caries, particularly in the approximal areas of the teeth. In 18.3% of cases, the carious process was underestimated, leading to disease progression and the need for repeated intervention. In contrast, in 9.5% of cases, overdiagnosis occurred, accompanied by excessive preparation of hard dental tissues. Particular attention was paid to the use of additional diagnostic methods during the analysis. It was found that in 34% of cases, radiographic examination was not performed, despite clinical indications. This significantly increased the risk of missing deep or secondary carious lesions. In the group of patients who used additional diagnostic methods, the frequency of diagnostic errors was significantly lower, confirming their high clinical value. An analysis of the treatment phase revealed that violations of preparation and filling techniques were observed in 31.1% of patients. The most common errors were insufficient isolation of the working field, failure to comply with adhesive protocols, and the incorrect choice of filling material. In 22% of cases, failure to use a rubber dam resulted in reduced restoration quality and the development of microleakage. The incidence of complications after caries treatment was 24.4%. The most common complications were postoperative hyperesthesia (10.6%) and secondary caries (7.8%). Pulpitis developed in 4.4% of patients, primarily in Group II with deep caries. In most cases, pulpitis was associated with overpreparation and inadequate pulp protection. Periodontitis was diagnosed less frequently (1.6%) and was typically a consequence of delayed pulpitis treatment. An analysis of anesthesia methods revealed that local infiltration anesthesia was used in 72% of cases, regional anesthesia in 21%, and no anesthesia in 7%. Insufficient anesthesia was observed in 14.5% of patients, primarily during the treatment of deep caries in lower molars. The main reasons were the incorrect choice of anesthesia method and

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insufficient anesthetic dosage. In the group of patients who used modern articaine-based anesthetics, anesthesia effectiveness was statistically higher. The relationship between physician qualifications and the frequency of errors was also assessed. The results showed that specialists with less clinical experience had a higher rate of diagnostic and treatment errors, emphasizing the importance of continuous professional training and clinical mentoring. Thus, the empirical analysis confirms that a significant portion of complications in dental caries treatment are due to diagnostic and tactical errors. The use of a comprehensive diagnostic approach, strict adherence to treatment protocols, adequate pain relief, and improved professional competence of doctors can significantly reduce the incidence of complications and improve the effectiveness of dental care.

Conclusion

The study suggests that errors and complications arising during the diagnosis and treatment of dental caries remain a pressing issue in modern therapeutic dentistry. Despite the availability of modern diagnostic methods, highly effective filling materials, and improved treatment protocols, clinical practice demonstrates a significant frequency of diagnostic and tactical inaccuracies, which negatively impact treatment outcomes and the prognosis for tooth preservation. The results of theoretical and empirical analysis revealed that the greatest number of errors are associated with underestimation of early and latent forms of caries, especially in approximal areas, as well as insufficient use of additional diagnostic methods. The lack of a comprehensive approach to patient examination and incorrect interpretation of clinical and radiographic data significantly increase the risk of misdiagnosis, which subsequently leads to the selection of inappropriate treatment strategies. It has been established that errors during caries treatment are often caused by poor cavity preparation techniques, failure to adhere to minimally invasive dentistry principles, and the improper selection and use of filling materials. Of particular importance is the quality of the sealing of the working field and strict adherence to adhesive protocols, which directly affect the tightness of the restoration and the risk of secondary caries. Insufficient pulp protection during deep caries treatment contributes to the development of inflammatory complications such as pulpitis and periodontitis, which require more complex and lengthy treatment. An analysis of complications revealed that postoperative hyperesthesia, secondary caries, and pain are the most common complications following caries treatment. These conditions significantly reduce patients' quality of life and contribute to a negative attitude toward dental treatment. Therefore, adequate pain relief plays a crucial role, being an integral component of high-quality dental care. A rational choice of method and anesthetic, taking into account the clinical situation and individual patient characteristics, improves treatment effectiveness and minimizes the risk of complications. An important finding of the study is the importance of preventing diagnostic and treatment errors. This should include systematically improving the professional qualifications of dentists, implementing clinical guidelines and treatment standards, and actively using modern diagnostic technologies. Equally important is motivating patients to undergo regular preventive examinations and maintain good oral hygiene. Thus, a comprehensive approach to the diagnosis and treatment of dental caries, based on evidence-based medicine, strict adherence to clinical protocols, and individualized treatment, can significantly reduce the incidence of errors and complications. Implementing these principles improves the quality of dental care, improves long-term treatment outcomes, and maintains the dental health of the population.

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