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THE PROBLEM OF ANTIBIOTIC RESISTANCE AND ITS IMPACT ON DENTISTRY

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Abstract
Antibiotic resistance is a growing problem in dentistry, as empirical therapy and improper use are leading to an increase in the population of resistant microorganisms in the oral cavity. Studies show that 30-40% of antibiotic prescriptions in dental practice are prescribed without indication. 25-35% of Streptococcus spp. are resistant to penicillin, and 40% of Prevotella species are resistant to beta-lactams. This situation reduces the effectiveness of the treatment of odontogenic infections, periodontitis and peri-implantitis. To solve the problem, it is recommended to adhere to the principles of rational antibiotic therapy, conduct microbiological diagnostics, use local antiseptics and alternative therapy methods. This approach allows to reduce the consumption of antibiotics by 35-40% and prevent the development of resistance.

Keywords: antibiotic resistance, dentistry, antimicrobial therapy, oral microbiome, rational antibiotic therapy.

Introduction

Antibiotic resistance (AR) is one of the most pressing medical problems of the 21st century. According to the World Health Organization (WHO), antibiotic-resistant infections cause 700,000 deaths per year. If current trends continue, this figure could reach 10 million by 2050.

Antibiotics are widely used in dentistry for odontogenic infections, periodontal diseases, peri-implantitis, and surgical interventions. However, empirical therapy, misuse for prophylactic purposes, and non-standardized approaches are leading to the growth of resistant microorganisms in the oral cavity.

Pathogenesis of Antibiotic Resistance: Antibiotic resistance occurs as a result of the development of defense mechanisms by microorganisms against antimicrobial drugs. The main mechanisms are:

1. Enzymatic inactivation - destruction of the antibiotic structure through the production of beta-lactamases
2. Targeting changes - modification of bacterial structures that are affected by the antibiotic
3. Efflux pumps - active release of antibiotics outside the cell
4. Decreased membrane permeability - limiting the entry of the drug into the cell

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The oral microbiome is unique in that it is home to over 700 bacterial species that live in biofilms. Biofilms are 1,000 times more resistant to antibiotics.

Use of antibiotics in dentistry:

In dental practice, antibiotics are used in the following cases:

- Acute odontogenic infections (periostitis, phlegmon, osteomyelitis)
- Periodontal abscesses and severe forms of periodontitis
- Peri-implantitis treatment
- Prevention before surgical interventions
- Prevention of infective endocarditis

Studies show that dentists write 10-15% of all antibiotic prescriptions, and in 30-40% of cases, antibiotics are prescribed without indication or in the wrong dosage.

Most commonly used drugs

The following antibiotics are widely used in dentistry:

-Amoxicillin - against Gram-positive and some Gram-negative bacteria
-Amoxicillin/clavulanate - against strains producing beta-lactamases
-Metronidazole - for anaerobic infections
-Azithromycin - an alternative in cases of allergies
-Clindamycin is the drug of choice for allergies to beta-lactams

Resistance issues in dentistry

Resistant strains in the oral cavity

Modern research shows that the following resistant microorganisms are increasing in the oral cavity:

Streptococcus spp. - penicillin resistance is noted in 25-35% of cases
Prevotella spp. - the proportion of beta-lactamase-producing strains reaches 40%
Fusobacterium nucleatum - metronidazole-resistant forms are emerging
Aggregatibacter actinomycetemcomitans - resistance to macrolides 15-20%

Clinical consequences

Antibiotic resistance is causing the following dental problems:

1. Treatment failure - progression of odontogenic infections to complex forms
2. The need for hospitalization - an increase in the number of severe cases
3. Prolongation of treatment duration - prolongation of the duration of the disease
4. Increased economic burden - increased treatment costs
5. Implant problems - peri-implantitis makes treatment more difficult

Strategies to prevent resistance

Principles of rational antibiotic therapy

1. Strict indication - use only when necessary
2. Microbiological diagnostics - cultural examination and antibiogram
3. Correct dosage - ensuring adequate concentration and duration
4. Narrow-spectrum drugs - targeted therapy as much as possible
5. Combination caution - avoiding unnecessary polychemotherapy

Prevention protocols

Prevention in surgical practice should be carried out based on the following principles:

- Identifying high-risk patients

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- Administer as a single dose 30-60 minutes before the start of the procedure
- If it lasts more than 2 hours, repeat dose
- Avoid prolonged postoperative use

Alternative approaches

The following methods are effective in reducing antibiotic use:

- Photodynamic therapy - in the destruction of anaerobes
- Laser therapy - disinfection and biostimulation
- Ozone therapy - antimicrobial effect
- Probiotics - restoring the oral microbiome
- Antiseptics - local antimicrobial agents

Monitoring and control system

To control antibiotic resistance, it is necessary to:

1. Epidemiological monitoring - monitoring the dynamics of resistance
2. Analysis of antibiotic consumption - volume and structure of use
3. Clinical audience - assessment of prescribing practices
4. Educational programs - advanced training for dentists
5. Patient education - awareness of proper antibiotic therapy

The problem of antibiotic resistance requires a comprehensive approach in dentistry. First of all, dentists need to clearly understand the indications for antibiotic use and avoid empirical therapy as much as possible. Expanding the capabilities of microbiological diagnostics is important for monitoring resistance and conducting targeted therapy.

Modern research shows that local antiseptics, mechanical cleaning, and alternative therapies in the treatment of dental diseases are often as effective as systemic antibiotic therapy, which can significantly reduce the use of antibiotics.

It is important to review prophylactic protocols. In many cases, modern surgical techniques and adherence to aseptic techniques eliminate the need for prophylactic antibiotic therapy.

Conclusion

Antibiotic resistance is a serious problem in dentistry, significantly reducing the effectiveness of treatment of odontogenic infections and periodontal diseases. The proportion of resistant microorganisms in the oral cavity, in particular beta-lactamase-producing strains, is increasing, which leads to the ineffectiveness of standard therapy regimens. The frequent use of antibiotics without indications and empirically in dental practice is the main reason for the development of resistance. To solve the problem, it is necessary to strictly adhere to the principles of rational antibiotic therapy, expand the capabilities of microbiological diagnostics, and widely use local antiseptics and alternative therapy methods. Modernization of prophylaxis protocols, introduction of a resistance monitoring system, and continuous improvement of the skills of dentists in antimicrobial therapy remain urgent tasks.

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