

## Antibiotic Resistance in Dental Infections: Investigating Common Bacterial Strains in Dental Abscesses and Their Resistance Patterns to Standard Antibiotics in Pakistan

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### 1. Introduction

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Dental infections, particularly **dental abscesses**, are among the most common oral health problems in Pakistan, affecting individuals across all age groups. These infections are often treated with empirical antibiotic therapy — most commonly amoxicillin, metronidazole, and amoxicillin-clavulanate — without microbiological confirmation. However, rising **antibiotic resistance (ABR)** due to overuse and misuse is compromising treatment efficacy. This study investigates the **prevalence of bacterial pathogens in dental abscesses** and their **resistance patterns to commonly prescribed antibiotics** in urban dental clinics across Pakistan, contributing to the national fight against antimicrobial resistance.

### 2. Objectives

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- To identify the most common bacterial strains isolated from dental abscesses (e.g., *Streptococcus* spp., *Staphylococcus aureus*, *Prevotella*, *Fusobacterium*).
- To determine resistance patterns to first-line antibiotics (amoxicillin, metronidazole, clindamycin, azithromycin).
- To detect the presence of resistance genes (e.g., *mecA*, *ermB*, *nim*) in isolates.
- To assess prescribing practices among dentists in Pakistan.
- To recommend evidence-based antibiotic guidelines for odontogenic infections.

### 3. Methodology

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**Study Design:** Prospective laboratory-based study with clinical correlation.

**Duration:** 10 months

**Study Sites:** Oral surgery departments of dental colleges and private clinics in Lahore, Karachi, and Faisalabad.

**Sample Size:** 250 patients with confirmed dental abscesses requiring incision and drainage or tooth extraction.

**Data Collection:**

- Pus samples collected under sterile conditions.
- Microbiological analysis: Gram staining, culture on selective media, and identification via biochemical tests or MALDI-TOF (if available).
- Antimicrobial Susceptibility Testing (AST): Kirby-Bauer disk diffusion method following CLSI guidelines.
- PCR testing for key resistance genes in MRSA and anaerobes.
- Survey of 50 dentists on antibiotic prescribing habits.

**Analysis:** WHONET software for resistance pattern analysis; SPSS for statistical evaluation.

### 4. Expected Findings

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- **Polymicrobial Infections:** 70–80% of abscesses will show mixed flora (aerobic and anaerobic bacteria).
- **High Resistance Rates:**
  - Amoxicillin resistance in >50% of *Streptococcus* and *Staphylococcus* isolates.
  - Metronidazole resistance in 20–30% of anaerobes.
  - MRSA presence in 10–15% of *S. aureus* isolates.
- **Common Resistance Genes:** Detection of *mecA* (MRSA), *ermB* (macrolide resistance), and *nim* (metronidazole resistance).
- **Prescribing Gap:** 60% of dentists prescribe antibiotics routinely, even for non-severe cases.

## 5. Significance in the Pakistani Context

This research addresses a critical but overlooked area of antimicrobial resistance in **dental healthcare**, where:

- Antibiotics are often self-prescribed or dispensed by pharmacists without prescription.
- Limited access to microbiology labs prevents culture-guided therapy.
- Dental education lacks strong emphasis on antibiotic stewardship.
- Patients expect antibiotics as part of treatment, increasing pressure on dentists.

Findings will support the **Pakistan Dental Council (PDC)** and **National Action Plan on Antimicrobial Resistance (NAP-AMR)** in developing **clinical guidelines for antibiotic use in dentistry** and promoting culture-based diagnosis.

## 6. Ethical Considerations

Informed consent will be obtained in Urdu or local language. The study will be reviewed by the RYKMDC Institutional Review Board (IRB). Patient confidentiality will be maintained. No additional harm or procedure is involved beyond standard care.

## 7. Budget Estimate (Total: PKR 280,000)

Item	Estimated Cost (PKR)
Laboratory Testing (Culture, AST, PCR)	120,000
Field Staff (Lab Technicians, Coordinators)	70,000
Sample Collection Kits & Transport	30,000
Dentist Survey & Data Management	25,000
Data Analysis & Reporting	35,000
<b>Total</b>	<b>280,000</b>

## 8. Conclusion

Antibiotic resistance in dental infections is a growing threat to public health in Pakistan. This study will provide the first comprehensive data on bacterial isolates and resistance patterns in dental abscesses, highlighting the urgent need for **\*\*antibiotic stewardship in dentistry\*\***. By promoting evidence-based prescribing, expanding access to microbiological testing, and educating dental professionals, we can preserve the effectiveness of life-saving antibiotics and improve patient outcomes across the country.

**Note:** This research aligns with WHO's Global Action Plan on Antimicrobial Resistance and supports Sustainable Development Goal 3 (Good Health and Well-being).

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