



Antibiotic Prescribing Patterns in Oral Implant Surgery among Dental Professionals in Pune City

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ABSTRACT

Background: Antibiotic resistance is a growing global health concern, largely driven by the irrational and excessive use of antibiotics. In oral implantology, prophylactic antibiotic use is common; however, its necessity in routine cases remains controversial. This study aimed to evaluate the current trends in antibiotic prescription practices among dental professionals performing implant surgeries in Pune City and to assess their adherence to evidence-based guidelines.

Methods: A cross-sectional, questionnaire-based survey was conducted among 92 dental practitioners involved in oral implant surgery in Pune. The questionnaire assessed demographic details, prescribing patterns (timing, type, and duration), clinical decision-making, and awareness of antibiotic stewardship and guidelines. Data were analysed using descriptive statistics and chi-square tests, with significance set at $p < 0.05$.

Results: The majority of practitioners (58.70%) had 5–15 years of implantology experience. Most respondents (44.57%) prescribed antibiotics both pre- and postoperatively, while 63.04% prescribed them for 5 days. Amoxicillin–clavulanic acid was the most commonly used antibiotic (84.78%). Only 39.13% were aware of established clinical guidelines, and 60.87% lacked such awareness. A significant proportion (72.83%) reported postoperative infections despite antibiotic use. Statistical analysis revealed highly significant variations in prescribing practices ($p < 0.001$), indicating inconsistent adherence to evidence-based protocols.

Conclusion: The study highlights considerable variability and a tendency toward overprescription of antibiotics in implant dentistry, along with limited awareness of guidelines. Strengthening antibiotic stewardship, promoting evidence-based protocols, and enhancing continuing dental education are essential to optimize prescribing practices and combat antimicrobial resistance.

KEYWORDS: Antibiotic stewardship; Dental implants; Antibiotic prescribing; Implant surgery; Antimicrobial resistance; Prophylaxis.

I. INTRODUCTION

The increasing resistance to antimicrobial drugs has become a global concern and poses a serious threat to human health. As bacteria develop resistance, modern medical treatments become less effective, making many diseases harder to manage and cure. This growing problem impacts not only healthcare systems but also society as a whole. Therefore, antibiotics should be used only when truly necessary, as their excessive use accelerates the emergence of resistant bacteria. To prevent this, antibiotic administration must be guided by well-established scientific evidence and clearly defined protocols.¹

The present article outlines a comprehensive investigation into the patterns of antibiotic prescription for oral implant surgery among dental practitioners in Pune city. The study focuses on evaluating practitioners' awareness, prescribing practices, and perceptions regarding antibiotic use in implant dentistry. Emphasis is placed on the necessity of formulating evidence-based guidelines to mitigate issues such as antibiotic overprescription and the escalating problem of antimicrobial resistance.²

The prophylactic use of antibiotics has become common practice, aimed at minimizing postoperative infections and implant failure. However, evidence supporting routine antibiotic use in otherwise healthy patients remains inconclusive, raising concerns about overprescription and its contribution to antimicrobial resistance.³ Recent trends have focused on the routine administration of antibiotic prophylaxis, with clinical research being examined to substantiate its application. For several decades, the use of antibiotics in dental surgical procedures has been advocated by major professional



associations. The CDA specifies that “all dental procedures involving significant oral bleeding and/or exposure to potentially contaminated tissue typically require antibiotic prophylaxis.”⁴

Pune City, being a major urban centre with a high density of dental professionals and clinics, provides a relevant setting to investigate current practices. Little is known about how dentists in Pune prescribe antibiotics in the context of implant surgery: which agents are preferred, on what indications (prophylactic vs therapeutic), timing and duration, and whether their practices align with evidence-based guidelines. Understanding the current scenario is essential for identifying areas of overprescription or inappropriate use, and for designing local stewardship efforts or guideline implementation.

Dental implants are recognized as a significant advancement in contemporary dentistry. The increasing preference for implant therapy among clinicians, along with the rising demand from patients for fixed prosthetic replacements, is well established in the scientific literature. Despite their widespread adoption, a proportion of implants may experience early failure during the remodelling phase, frequently attributable to bacterial contamination. This clinical concern has heightened the need for effective antibacterial measures to mitigate the risk of implant failure. Accordingly, the preoperative administration of antibiotics is frequently advocated as a preventive strategy against infection and subsequent implant complications, particularly in the presence of local or systemic risk factors.⁵

The long-term success of a dental implant primarily depends on its ability to achieve and maintain osseointegration with the surrounding bone tissue.⁶ Complications following dental implant placement are broadly categorized into mechanical and biological types. Biological complications encompass postoperative infections, plaque accumulation, and peri-implant bone loss, all of which may compromise osseointegration and implant stability.

These biological failures are further classified as early or late implant failures. Early failures typically arise due to inadequate aseptic control during surgery or disturbances in the initial healing phase, preventing proper integration of the implant with the surrounding bone. In contrast, late complications are commonly associated with peri-implantitis and chronic infections resulting from bacterial plaque accumulation around the implant surface.⁷ Several predisposing factors significantly influence the success and long-term survival of

dental implants. Systemic and local conditions such as uncontrolled diabetes mellitus, smoking, active or untreated periodontitis, prolonged corticosteroid use, and a history of radiation or chemotherapy can adversely affect osseointegration and wound healing. To minimize the risk of postoperative and biological complications associated with these conditions, the use of antibiotic prophylaxis before and after implant surgery is often advocated as a preventive measure.⁸

The predictability and overall success of dental implants may be compromised by biological complications that contribute to implant failure. Esposito et al. identified peri-implant infections as a principal cause of biological failure. Furthermore, contemporary evidence indicates that the administration of prophylactic antibiotics can significantly reduce the incidence of implant failure.⁹⁻¹²

Methods

Study Design

Cross-sectional questionnaire-based survey.

Study Population

Dental practitioners performing oral implant surgery in Pune City.

Sample Size

Total participants: 92

Inclusion Criteria

- Registered dentists practicing in Pune
- Actively performing implant surgery

Data Collection

A structured questionnaire assessed:

- Years of implant experience
- Implant volume per month
- Antibiotic timing (pre/post)
- Type and duration of prescription
- Awareness of guidelines
- Familiarity with antibiotic stewardship

Statistical Analysis

Data were analysed using SPSS software.

Chi-square test applied for associations.

Significance level: $p < 0.05$.

II. RESULTS

1. Years of Experience in Implantology

Out of 92 respondents, 58.70% had 5–15 years of implantology experience, 26.09% had 0–5 years, and 15.22% had more than 15 years.

This indicates that the majority of respondents are experienced practitioners, reflecting a mature and established professional demographic in the field of implantology.

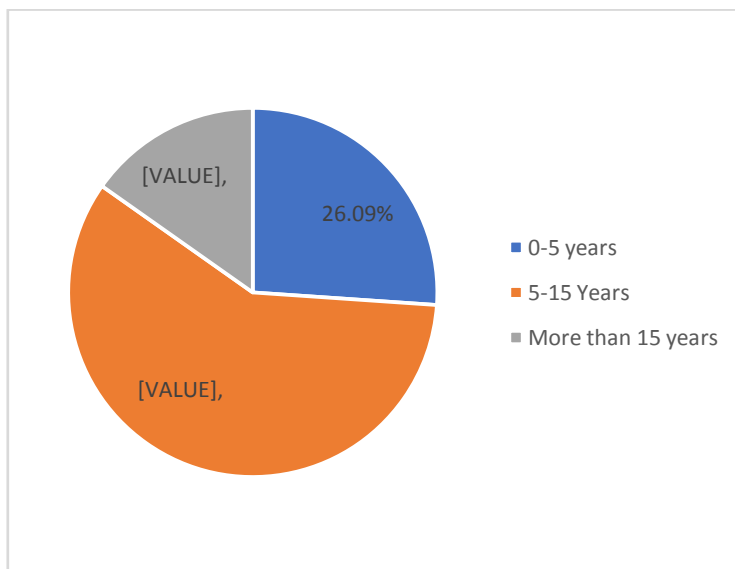


Figure 1: Years of Experience in Implantology

2. Average Number of Implants Placed per Month
A majority (59.78%) reported placing 5–15 implants per month, followed by 15.22% who placed 0–5, 13.04% placed 15–30, and 11.96% placed more than 30.

This reflects that most practitioners maintain a moderate monthly case volume, balancing quality and workload.

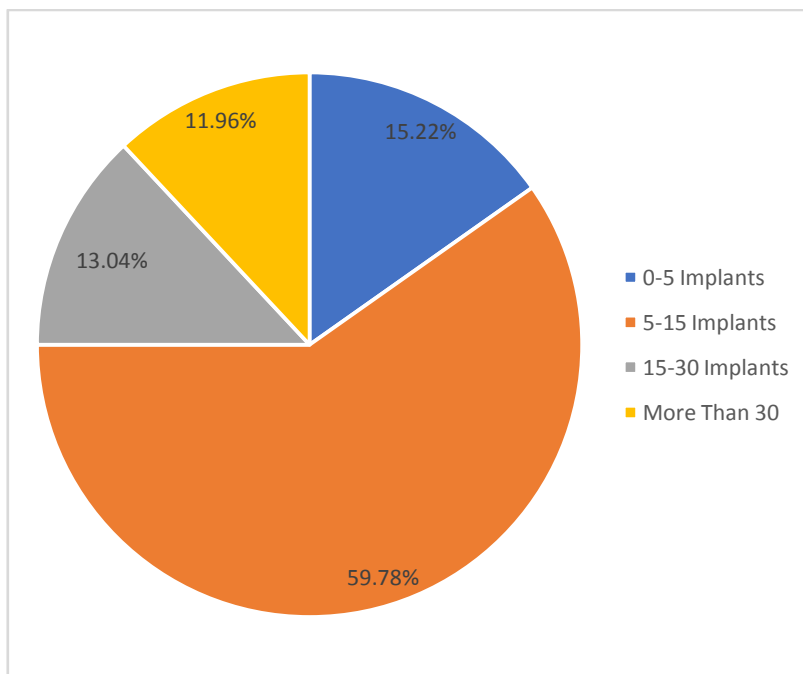


Figure 2: Implants Placed Monthly

3. Implant Placement in Medically Compromised Patients
58.70% of respondents placed implants in medically compromised patients, 26.09% said it

depends on the case, while 15.22% avoided such cases.
The chi-square test value ($\chi^2 = 22.978$, $p < 0.001$) indicates a highly significant difference, showing varied clinical judgment among practitioners.

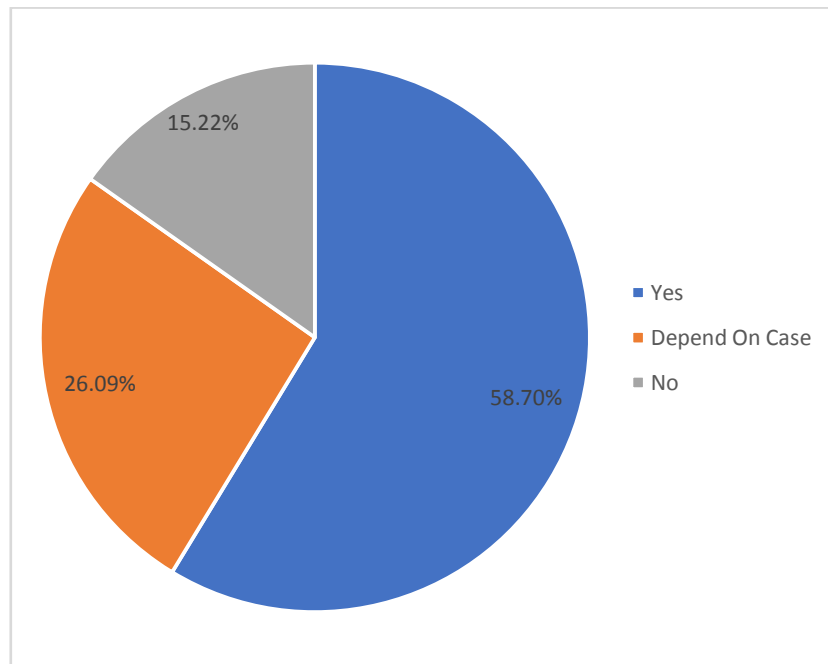


Figure 3: Implant Placement in Medically Compromised Patients

4. Timing of Antibiotic Prescription

Most practitioners (44.57%) prescribed antibiotics both pre- and postoperatively, while 38.04% prescribed postoperatively only.

A small proportion prescribed preoperatively only (8.7%) or did not prescribe routinely (6.52%). The chi-square test ($\chi^2 = 104.174$, $p < 0.001$) showed a highly significant difference, indicating diverse antibiotic protocols.

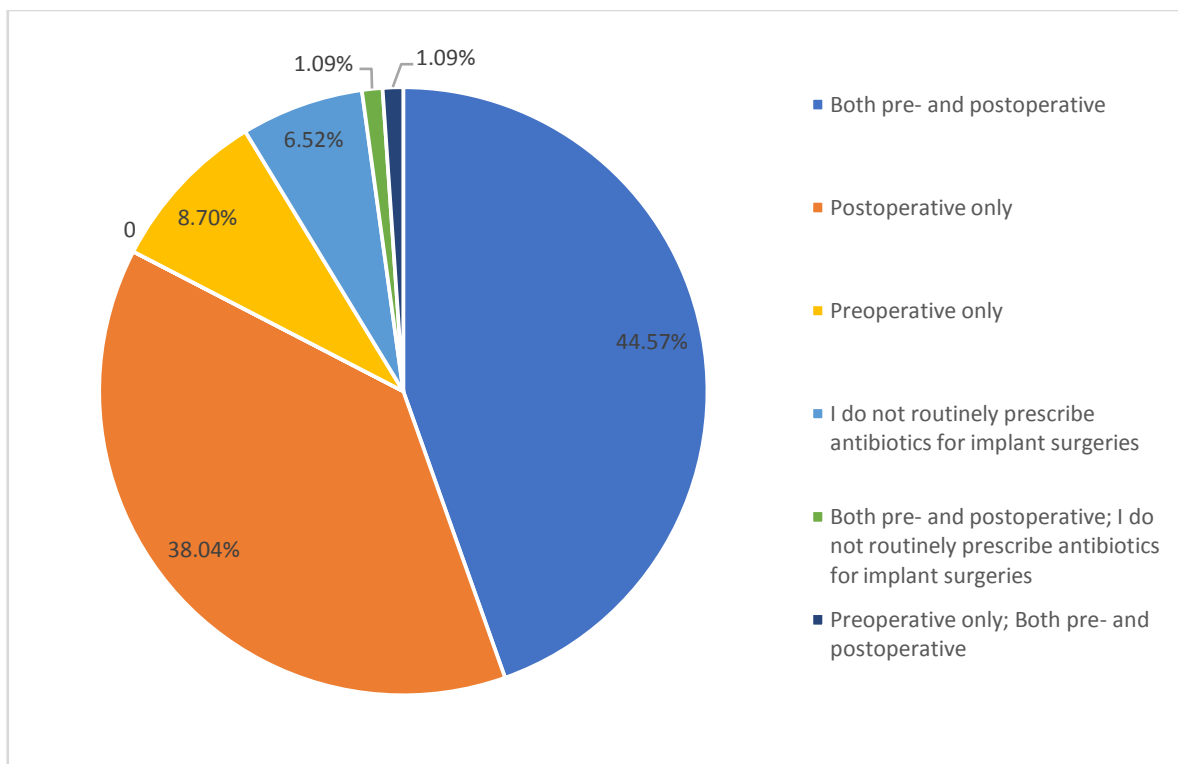


Figure 4: Timing of Antibiotic Prescription



5. Commonly Prescribed Antibiotic Regimen

A strong majority (84.78%) used Amoxicillin-Clavulanic Acid (625 mg TID for 5 days), followed by Amoxicillin 500 mg (8.7%), Azithromycin (3.26%), and other antibiotics (3.26%).

The chi-square value ($\chi^2 = 176.087$, $p < 0.001$) indicated a highly significant preference, showing uniformity in antibiotic selection,

6. Duration of Antibiotic Prescription

Most respondents (63.04%) prescribed antibiotics for 5 days, while 36.96% opted for 3 days. The chi-square test ($\chi^2 = 6.261$, $p < 0.05$) indicated a significant difference, suggesting some inconsistency in treatment duration.

7. Prescription Differences Between Healthy and Medically Compromised Patients

61.96% prescribed differently for medically compromised patients, 34.78% did not, and 3.26% were uncertain.

The chi-square test ($\chi^2 = 47.63$, $p < 0.001$) showed a highly significant difference, confirming awareness of patient health conditions.

8. Awareness of Clinical Guidelines

Only 39.13% were aware of international guidelines (AAP, AAID, EAO), while 60.87% were not.

The chi-square test ($\chi^2 = 4.348$, $p < 0.05$) showed a significant difference, highlighting the need for better guideline dissemination.

9. Belief in Single Preoperative Dose Sufficiency

41.3% did not believe a single preoperative dose was sufficient, 39.13% were unsure, and 19.57% agreed.

The chi-square test ($\chi^2 = 7.913$, $p < 0.05$) was significant, indicating divided opinions on single-dose efficacy.

10. Familiarity with Antibiotic Stewardship

Responses were nearly balanced: 29.35% not familiar, 28.26% very familiar, 22.83% heard but unclear, and 19.57% somewhat familiar.

The chi-square test ($\chi^2 = 2.348$, $p \geq 0.05$) was not significant, suggesting general awareness but uneven understanding

11. Postoperative Infection Despite Antibiotic Use

A large majority (72.83%) encountered infections despite antibiotic use, while 14.13% were unsure and 13.04% had none.

The chi-square test ($\chi^2 = 64.587$, $p < 0.001$) was highly significant, emphasizing the need for rational antibiotic use.

12. Prescription for All Implant Cases

41.31% prescribed antibiotics based on patient factors, 38.04% prescribed for all cases, and 20.65% only for complex cases. The chi-square test ($\chi^2 = 23.043$, $p < 0.001$) was highly significant, reflecting differing risk assessment strategies.

13. Primary Goal for Preoperative Antibiotic Use

Half (50%) prescribed antibiotics to reduce site contamination, 32.61% for favorable wound healing, 16.3% to decrease implant failure, and 1.09% cited other reasons.

The chi-square test ($\chi^2 = 48.957$, $p < 0.001$) was highly significant, highlighting infection prevention as the leading rationale.

- Majority of respondents are experienced (5–15 years) implantologists.
- Amoxicillin-Clavulanic Acid is the most preferred antibiotic.
- Significant variation exists in timing and duration of antibiotic use.
- Awareness of guidelines remains limited, and antibiotic stewardship understanding needs improvement.

Despite antibiotic use, a high incidence of postoperative infection suggests potential overreliance or misuse.

III. DISCUSSION

The present study evaluated the antibiotic prescription patterns among dental practitioners performing oral implant surgeries in Pune City. The findings revealed that while most respondents were experienced practitioners, considerable variability exists in antibiotic prescription timing, duration, and adherence to established clinical guidelines.

In the present study, most respondents (58.7%) reported 5–15 years of experience in implantology, with nearly 60% placing 5–15 implants per month, indicating a cohort of experienced, mid-career practitioners actively involved in implant practice. Similarly, Shah et al. (2021) observed that over half of Indian dental professionals practicing implantology had 6–15 years of experience, aligning with the present findings and reinforcing that mid-career clinicians predominantly drive implant practice in India's urban regions. In contrast, Dhanraj et al. (2022) reported lower levels of experience and limited adherence to clinical guidelines among practitioners in South India, suggesting variability in professional maturity and protocol awareness across regions. Compared to these studies, the



present findings reflect a more professionally established and guideline-aware cohort, highlighting the advanced stage of implant practice in metropolitan settings like Pune.¹³⁻¹⁴

The study revealed that 44.6% of practitioners prescribed antibiotics both preoperatively and postoperatively, whereas 38% limited their prescriptions to the postoperative period. This trend indicates a tendency toward extended antibiotic use, which deviates from evidence-based protocols recommending minimal prophylaxis. Systematic reviews by Esposito et al. (2013) and Romandini et al. (2019) have shown that a single preoperative antibiotic dose—commonly 2 g of amoxicillin administered one hour prior to surgery—is adequate to minimize early implant failures and postoperative infections. Despite this, extended courses were common, with 63% prescribing for 5 days postoperatively—reflecting overprescription consistent with global and Indian trends.¹⁵⁻¹⁶

Amoxicillin-Clavulanic Acid (625 mg TID for 5 days) emerged as the predominant antibiotic (84.8%), followed by Amoxicillin (8.7%) and Azithromycin (3.3%). Although amoxicillin remains the recommended first-line prophylactic agent, the frequent use of broad-spectrum combinations such as amoxicillin–clavulanic acid for routine implant cases indicates a pattern of overprescription and possible deviation from evidence-based protocols. According to the American Academy of Osseointegration (2018) and the European Association for Osseointegration (2020), prophylactic antibiotic use should be limited to high-risk or complex implant procedures, and extended-spectrum antibiotics should be avoided in routine cases.¹⁷⁻¹⁸ The prescribing trend observed in the present study contrasts with these guidelines, suggesting the persistence of defensive prescribing behaviours among practitioners. Similar findings were reported by Kumar et al. (2022) in a multicentric study, where 77% of dentists prescribed broad-spectrum antibiotics unnecessarily, citing fear of postoperative infection and medicolegal concerns as primary motivations. Compared to these studies, the present findings reinforce the need for stronger antibiotic stewardship and guideline awareness to curb the misuse of extended-spectrum antibiotics in implant dentistry.¹⁹

Only 39.1% of respondents were aware of international antibiotic guidelines such as those by the AAP, AAID, or EAO, reflecting a substantial knowledge gap among practitioners. Similar observations were made by Khattri et al. (2021), where less than 45% of dentists demonstrated

familiarity with standard prophylactic protocols, and by Ramu and Padmanabhan (2012), who reported inconsistent guideline adherence leading to irrational antibiotic use.²⁰⁻²¹ The ICMR (2019) and WHO (2020) have emphasized rational, narrow-spectrum antibiotic use and short prophylactic courses to combat antimicrobial resistance.²²⁻²³ Compared to these standards, the present findings highlight the continued lack of awareness and adherence to global and national recommendations, underscoring the urgent need for enhanced professional education and antibiotic stewardship initiatives in dental practice.

72.8% of practitioners reported encountering postoperative infections despite antibiotic use, underscoring that antibiotic prophylaxis alone is insufficient for infection prevention. This finding highlights the importance of surgical technique, asepsis, and patient-related factors in ensuring implant success. Mombelli and Décaillet (2011) similarly emphasized that peri-implant infections are primarily associated with microbial colonization and biofilm formation, rather than antibiotic failure alone.²⁴ Jepsen et al. (2018) further noted that effective prevention of peri-implant diseases relies on strict infection control measures, atraumatic surgical procedures, and maintenance care, rather than routine antibiotic use.²⁵ Moreover, Llor and Bjerrum (2014) cautioned that excessive or prolonged antibiotic use contributes to the rise of antimicrobial resistance and diminishes long-term drug efficacy.²⁶ In alignment with these studies, the present findings suggest that infection control in implantology should prioritize aseptic surgical protocols and patient management, with antibiotics reserved as a supportive—not primary—preventive measure.

Although nearly half of the participants reported some awareness of antibiotic stewardship, their understanding was largely superficial, indicating a gap between conceptual knowledge and practical application. True antibiotic stewardship requires the appropriate selection, dosage, and duration of antimicrobial therapy to minimize misuse and resistance. Cope et al. (2017) similarly emphasized that awareness alone does not translate into responsible prescribing; effective stewardship in dentistry demands behavioural change, ongoing education, and system-level interventions.²⁷ Their review called for integrating antimicrobial stewardship principles into routine dental practice through targeted training.

Patterns of postoperative antibiotic use beyond evidence-based recommendations were consistent with findings reported internationally. Al-Rasheed et al. (2019) observed that the majority



of Saudi dentists routinely prescribed postoperative antibiotics, often extending the duration beyond clinical necessity, primarily due to concerns over postoperative infection and patient reassurance.²⁸ Similarly, Martínez et al. (2018) found that Spanish implantologists frequently prescribed antibiotics prophylactically, even in uncomplicated cases, reflecting a tendency toward cautious overprescription.²⁹ Comparable trends in Italy and other European regions further demonstrate that this issue extends beyond national boundaries. Together, these findings and the present study highlight a global disconnect between clinical guidelines and real-world practice, emphasizing the need for stronger adherence to evidence-based protocols and enhanced stewardship education among implant practitioners worldwide.

IV. CONCLUSION

Antibiotic prescribing patterns among implant practitioners in Pune City show considerable variability, with a predominance of extended postoperative regimens. Current evidence supports limited prophylactic use—primarily a single preoperative dose—in uncomplicated cases. Strengthening awareness of evidence-based guidelines and promoting antibiotic stewardship are essential steps toward optimizing implant care and combating antimicrobial resistance.

Clinical Significance

This study highlights the gap between evidence-based recommendations and actual prescribing practices in implant dentistry. The findings emphasize the need for rational antibiotic use, particularly limiting unnecessary postoperative prescriptions in uncomplicated implant procedures. Adoption of evidence-based protocols and antibiotic stewardship principles can help reduce antimicrobial resistance, minimize adverse drug reactions, and improve overall patient safety in routine implant practice.

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