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A Cross-sectional Study to Investigate the Awareness of General Dental Practitioners Toward Chlorhexidine Prescription in Dental Clinics in Babylon Province

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ABSTRACT

Background and Aim: Chlorhexidine gluconate is a broad-spectrum antiseptic agent commonly prescribed in dental practice for managing plaque-induced gingivitis, post-surgical oral hygiene, and certain periodontal conditions. Despite its effectiveness, the irrational and frequent prescription of Chlorhexidine mouthwash, particularly in the absence of clear clinical indications, poses significant concerns regarding patient safety, emergence of antimicrobial resistance, and unnecessary financial burden. General dental practitioners (GDPs), who play a critical role in prescribing habits, often vary in their level of awareness regarding evidence-based indications, dosage regimens, side effects, and duration of use. The present study aimed to assess the level of knowledge, awareness, and clinical practices among GDPs in Babylon Province, Iraq, regarding the rational use of Chlorhexidine mouthwash, and to identify existing knowledge gaps that may lead to inappropriate or over prescription. Methods: This descriptive cross-sectional study was conducted using a validated online structured questionnaire, distributed among general dental practitioners across Babylon Province between March 14 and April 15, 2024. The survey consisted of 25 multiple-choice and Likert-scale questions addressing dentists' knowledge of chlorhexidine's pharmacological properties, appropriate clinical indications, prescription habits, awareness of side effects, and attitude toward antimicrobial stewardship. Out of 259 respondents, 178 qualified as GDPs and their responses were subjected to statistical analysis using descriptive frequencies and percentage distributions. Results: Findings revealed a significant variability in knowledge among practitioners. A large proportion of GDPs reported routine prescription of Chlorhexidine irrespective of clinical necessity. While 85% of respondents recognized its antibacterial action, only 42% demonstrated awareness of its potential adverse effects, such as tooth staining, taste alteration, and mucosal desquamation. Over 60% of GDPs reported prescribing Chlorhexidine for non-indicated procedures such as simple extractions or scaling in healthy individuals. Additionally, less than 30% reported awareness of resistance development associated with prolonged or unnecessary use. Conclusion: The study identified a critical gap in knowledge and awareness among GDPs regarding the appropriate prescription of Chlorhexidine mouthwash. Overuse and misuse were notably common, underscoring the urgent need for continuing professional development and educational interventions focused on rational prescribing practices. Promoting evidence-based guidelines in dental education and clinical practice is essential to enhance patient safety, improve therapeutic outcomes, and curb the rising threat of antimicrobial resistance.

Keywords: Chlorhexidine gluconate, dental mouthwash, general dental practitioners, prescribing practices, antimicrobial resistance, oral hygiene agents

1 Introduction

Chlorhexidine gluconate is an antiseptic agent with broad-spectrum efficacy against Gram-positive and Gram-negative bacteria, fungi, and some viruses. Its use in dentistry is well-documented, particularly for short-term management of plaque control, gingival inflammation, and as a postoperative adjunct to mechanical debridement. Introduced in the 1950s, Chlorhexidine has become a cornerstone in dental antimicrobial protocols due to its substantively and relatively low systemic toxicity [1,2]. However, over the decades, growing concerns have emerged regarding its inappropriate use, unnecessary prescription, and adverse effects—especially when used indiscriminately by general dental practitioners (GDPs) without clear clinical justification [3,4].

In daily clinical practice, GDPs often prescribe Chlorhexidine as a preventive or therapeutic mouthwash, not always aligned with the guidelines issued by national or international dental health authorities. Studies have shown that dentists may rely more on anecdotal experience, patient demand, or commercial promotion rather than on evidence-based indications, leading to misuse [5,6]. The routine prescription of Chlorhexidine, especially in cases where local interventions are sufficient (such as uncomplicated scaling, extraction, or minor soft-tissue trauma), contributes not only to unnecessary healthcare costs but also to emerging antimicrobial resistance patterns and alteration of the oral microbiota [7,8].

The adverse effects of long-term or irrational use of Chlorhexidine are well documented. These include extrinsic tooth staining, taste disturbances (dysgeusia), burning sensations, mucosal irritation, and in rare instances, hypersensitivity reactions[9]. Additionally, emerging research has pointed toward bacterial resistance mechanisms that may be induced with prolonged Chlorhexidine exposure, including efflux pump activation and cross-resistance to systemic antibiotics (10). In light of the global emphasis on antimicrobial stewardship, such findings warrant a more cautious and rational approach to prescribing antiseptic agents in dental settings[11].

Rational prescribing entails the right drug, at the correct dose, for the appropriate duration, and only when clinically indicated. Evidence suggests that GDPs often deviate from this principle in their day-to-day practice, either due to insufficient pharmacological knowledge or gaps in continuing education[12]. For example, Chlorhexidine mouthwash should be limited to cases such as postoperative care following periodontal surgery, in high-risk caries patients, during acute necrotizing periodontal infections, or in patients with compromised manual dexterity [13]. It is not recommended as a routine adjunct in healthy individuals undergoing prophylaxis or scaling without underlying disease.

In Iraq, where public health awareness and clinical resources may vary regionally, little published data exists evaluating the awareness of GDPs regarding Chlorhexidine use. The present study addresses this gap by exploring the prescribing behaviors and knowledge level of GDPs in Babylon Province. By identifying trends in over prescription, misperceptions about clinical indications, and lack of awareness of potential complications, this study aims to inform future interventions and guidelines that promote responsible use of antimicrobial oral agents in dental practice.

2 Allergy, and Resistance Concerns in Dental Use of Chlorhexidine and Associated Agents

2.1 Drug Interactions in Dental Practice:

In dental settings, several commonly prescribed medications, including antibiotics and antiseptic agents like Chlorhexidine, may interact adversely with other systemic drugs. These interactions can potentiate side effects or reduce therapeutic efficacy, thereby placing patients at risk. Awareness of such interactions is essential for general dental practitioners (GDPs) to ensure patient safety and effective treatment outcomes.

- Amoxicillin and Aspirin: Co-administration can lead to reduced metabolism of aspirin due to modulation of intestinal microflora, thereby increasing the risk of gastrointestinal irritation and other adverse effects[14].
- Amoxicillin/Clavulanate and Warfarin: Though rare, this combination may potentiate warfarin's anticoagulant effect, increasing INR (International Normalized Ratio) and bleeding risk, which may become life-threatening[15].
- Metronidazole and Alcohol: Metronidazole inhibits aldehyde dehydrogenase, leading to accumulation of acetaldehyde. This causes a disulfiram-like reaction characterized by flushing, palpitations, nausea, headache, and vomiting. Patients should be advised to avoid alcohol consumption during and for at least 72 hours after the completion of metronidazole therapy.
- Metronidazole and Lithium: Metronidazole reduces renal excretion of lithium, which may lead to lithium toxicity. Symptoms include tremors, confusion, ataxia, and renal dysfunction. Monitoring of lithium

levels is advised when co-prescribed.

- Erythromycin and Digoxin: Erythromycin can suppress gut flora, specifically Eubacterium lentum, which metabolizes oral digoxin in approximately 10% of patients. This may result in elevated digoxin levels, leading to toxicity characterized by nausea, visual disturbances, and arrhythmias.
- Erythromycin, Clarithromycin, and Warfarin: These macrolides inhibit warfarin metabolism, enhancing its anticoagulant effect. Clinical signs include easy bruising, hematuria, and hematoma formation. INR should be monitored closely.
- Antibiotics and Oral Contraceptives: Antibiotics such as penicillin, cephalosporin, erythromycin, clarithromycin, tetracycline, and metronidazole can impair enterohepatic recirculation of estrogen, potentially reduce the efficacy of combined oral contraceptives and result in unintended pregnancy [16]. Dentists should advise patients to use additional contraceptive measures during antibiotic therapy.

2.2 Chlorhexidine Allergy Considerations:

Chlorhexidine, though generally well tolerated, may cause hypersensitivity reactions in some patients. Dental practitioners must obtain a detailed medical and allergy history prior to its use. Symptoms of hypersensitivity can range from localized urticaria to systemic anaphylaxis. Although Chlorhexidine allergy is relatively rare, its clinical implications are serious and necessitate prompt discontinuation and appropriate emergency management [17].

Patients allergic to penicillin may also have a cross-allergy to cephalosporin (estimated in 10–15% of cases, particularly in those with a history of anaphylaxis). In such situations, clindamycin is commonly recommended as an alternative antibiotic due to its effective anaerobic coverage and good bone penetration.

2.3 Concerns About Chlorhexidine Resistance:

Antibiotic resistance has become one of the foremost global health challenges. While Chlorhexidine is not an antibiotic per se, its widespread and often inappropriate use in dental and medical practices has been linked to the emergence of resistance among oral microorganisms [18]. Resistance to antiseptics like Chlorhexidine may occur through various mechanisms, such as:

- Alteration in bacterial membrane permeability,
- Efflux pump activation,
- Cross-resistance with systemic antibiotics.

According to the WHO, antimicrobial resistance causes approximately 70,000 deaths annually, a number projected to increase significantly unless stringent antibiotic stewardship measures are implemented [19].

General dental practitioners contribute substantially to community-level antimicrobial resistance due to the high rate of empiric and sometimes unnecessary prescriptions. Studies indicate that 30–50% of antibiotics prescribed by dentists are either unnecessary or incorrectly dosed [20]. Notably, many of these prescriptions are issued for conditions that do not require systemic antimicrobial therapy, such as mild gingivitis or uncomplicated extractions.

2.4 Recommendations for Rational Chlorhexidine and Antibiotic Use in Dental Practice:

To combat rising resistance and promote patient safety, it is critical that all dental practitioners follow established prescribing guidelines. Recommendations include [21]:

- Restricts use clearly indicated conditions: Chlorhexidine and antibiotics should only be prescribed as adjuncts to active treatment, not as substitutes for mechanical debridement or surgical intervention.
- Prefer narrow-spectrum agents: When antibiotics are necessary, narrow-spectrum options aligned with current clinical guidelines should be used to minimize collateral microbial damage.
- Correct dosage and duration: Prescriptions should adhere to evidence-based dosing regimens to avoid underdosing (risk of resistance) or overdosing (risk of toxicity).
- Patient education: Dentists must clearly inform patients on the correct usage of prescribed drugs, potential side effects, and the importance of adherence.
- Avoid prescriptions on patient demand: If a patient insists on receiving antibiotics or mouthwash without medical justification, practitioners should provide appropriate education rather than comply with non-evidence-based requests.

3 Material and Methods

3.1 Study Design and Setting

This research was designed as a descriptive cross-sectional survey and conducted among general dental practitioners (GDPs) working in both private and governmental dental clinics in Babylon Province, Iraq. Participation was entirely voluntary, and informed electronic consent was obtained from all respondents prior to data collection.

Study Population and Sampling

The target population included licensed GDPs registered with the Iraqi Dental Association – Babylon branch. A purposive sampling approach was used to include dentists actively engaged in daily clinical practice. Dental specialists and non-practicing dentists were excluded to maintain homogeneity of the sample.

Out of 259 responses, 178 were verified as GDPs and fulfilled the inclusion criteria. Incomplete or duplicate responses were excluded. Based on the estimated number of GDPs in Babylon Province (~600), the sample achieved represented a confidence level of 95% with a margin of error of ±6%, which

was considered adequate for statistical validity [1].

3.2 Survey Instrument

Data were collected using a validated, self-administered structured questionnaire developed after an extensive literature review[2–5]. The questionnaire was adapted from previously published studies on antimicrobial prescribing in dentistry and was modified to include items specific to Chlorhexidine prescription practices.

The final survey consisted of 25 items divided into five domains:

- **Demographic information** (age, gender, years of practice, workplace type).
- **Knowledge of Chlorhexidine pharmacology** (mechanism of action, concentrations, formulations).
- **Clinical indications and prescription practices** (postoperative use, periodontal care, prophylaxis).
- **Awareness of side effects, contraindications, and drug interactions**.
- **Attitude toward antimicrobial stewardship and resistance concerns**.
- The questionnaire was pretested among **20 GDPs** not included in the final study to ensure clarity and reliability. Internal consistency was measured using **Cronbach's alpha (α = 0.81)**, confirming good reliability.

3.3 Data Collection Procedure

The survey was distributed online via Google Forms, using professional dental networks, emails, and social media groups of the Iraqi Dental Association. To minimize duplicate submissions, each response was linked to a unique email address, and IP tracking was applied. Participants were given three reminders over the four-week study period to improve the response rate.

3.4 Data Analysis

Completed responses were exported to IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA) for analysis. Descriptive statistics were used to summarize categorical variables as frequencies and percentages, while continuous variables (e.g., years of experience) were expressed as mean ± standard deviation (SD). Associations between demographic characteristics and awareness levels were explored using the Chi-square test or Fisher's exact test where appropriate. A p-value <0.05 was considered statistically significant.

4 Results

Use and Awareness of Chlorhexidine Among Dental Practitioners, out of 233 dentists who completed the survey, 178 were general dental practitioners (GDPs), whose responses were analyzed. The use of Chlorhexidine (CHX) in clinical practice was assessed in terms of indications, concentration, duration, awareness of side effects, interactions, and resistance concerns.

4.1 Common Indications for Prescribing or Recommending Chlorhexidine

Among the GDPs surveyed:

- 77.5% (138/178) reported using CHX as an adjunct to mechanical plaque control.
- 65.2% (116/178) prescribed CHX following periodontal procedures (e.g., scaling and root planning).
- 49.4% (88/178) used CHX for post-extraction oral hygiene maintenance.
- 36.5% (65/178) recommended CHX for management of oral ulcers or mucositis.
- 18.5% (33/178) reported using CHX for pre-procedural rinsing to reduce microbial load.

TABLE 1. Common Clinical Indications for Chlorhexidine Use.

Indication	Frequency (n)	Percentage (%)
Adjunct to plaque control	138	77.5
After periodontal therapy	116	65.2
After tooth extraction	88	49.4
Oral ulcers/mucositis	65	36.5
Pre-procedural rinse	33	18.5

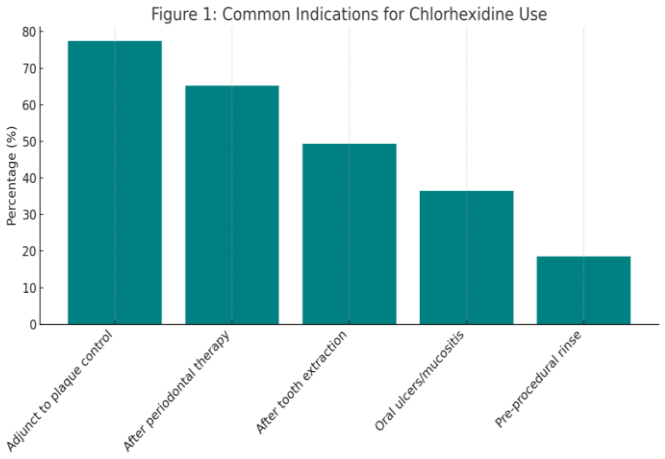

Fig. 1. Bar chart showing frequency of CHX indications among respondents.

4.2 Knowledge of Chlorhexidine Concentrations and Formulations:

63.5% (113/178) correctly identified 0.12% or 0.2% CHX as the standard concentration for mouthwash.

21.3% (38/178) believed higher concentrations (e.g., 2% or 4%) could be used for oral rinses, which may increase the risk of mucosal irritation.

15.2% (27/178) were unsure of the standard concentration.

4.3 Duration and Frequency of Use:

Only 58.4% (104/178) of GDPs recommended CHX use for no more than 2 weeks, which aligns with current guidelines

to avoid adverse effects.

41.6% (74/178) advised longer use (>2 weeks), increasing the risk of tooth staining, taste alteration, and mucosal irritation.

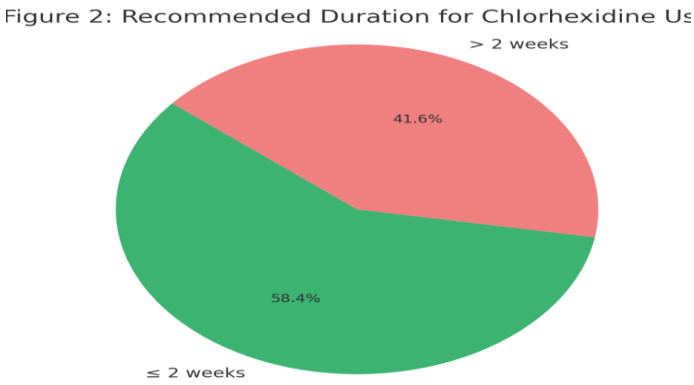

Fig. 2. Pie chart showing GDP recommendations on CHX usage duration.

4.4 Awareness of Side Effects and Patient Instructions:

When asked about adverse effects and patient counseling:

72.5% (129/178) were aware of tooth staining as the most common side effect.

57.3% (102/178) recognized taste alteration.

39.3% (70/178) acknowledged mucosal burning or desquamation.

However, 22.5% (40/178) admitted they rarely warn patients about potential adverse effects.

TABLE 2. Awareness of Chlorhexidine Adverse Effects

Adverse Effect	Aware (n)	Percentage (%)
Tooth staining	129	72.5%
Taste alteration	102	57.3%
Mucosal irritation	70	39.3%
Do not counsel patients	40	22.5%

4.5 Knowledge of Drug Interactions Involving Chlorhexidine:

Only 41.6% (74/178) of GDPs reported being aware of drug interactions involving CHX.

Notably, 26.4% (47/178) were aware of inactivation of CHX by sodium lauryl sulfate (SLS) in toothpaste and advised patients to wait at least 30 minutes after brushing before rinsing.

Very few respondents (<10

6. Awareness of Chlorhexidine Allergy and Resistance:

Only 36.0% (64/178) of respondents were aware that Chlorhexidine can cause allergic reactions, including rare anaphylaxis.

Awareness of bacterial resistance to CHX was also low, with just 28.1% (50/178) acknowledging that long-term or excessive use may lead to adaptation of oral flora and reduced antiseptic efficacy [22].

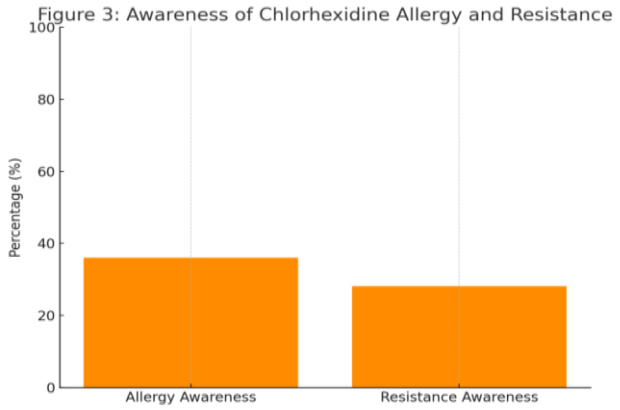

Fig. 3. Awareness of Chlorhexidine allergy and resistance risks among GDPs.

Summary of Findings:

- The survey revealed that Chlorhexidine is widely used among general dental practitioners, predominantly for plaque control and post-periodontal procedures.
- Knowledge gaps exist regarding the appropriate duration, concentration, and adverse effects associated with CHX use.
- A significant portion of GDPs are unaware of the potential interactions, risks of allergic reactions, and emerging resistance associated with indiscriminate or prolonged CHX use.
- These findings support the need for continuing education and updated clinical guidelines for the rational use of dental practice.

5. Conclusion:

This study highlights significant gaps in the awareness and prescribing practices of general dental practitioners concerning the use of Chlorhexidine in routine dental practice. While most practitioners are familiar with its common indications—such as in plaque control and postoperative care—a considerable portion lacks adequate knowledge regarding its appropriate duration of use, potential adverse effects, and the risks of resistance and hypersensitivity reactions. Alarmingly, a noteworthy number of practitioners continue to prescribe Chlorhexidine in scenarios where it is not clinically indicated, reflecting a broader iss%) were aware of potential interactions between CHX and certain systemic antibiotics (e.g., amoxicillin, metronidazole) via macrobiotic alterations.ue of irrational prescription patterns in dental care.

These findings underscore the necessity of targeted educational efforts and clinical guidelines to optimize Chlorhexidine use. Over prescription and misuse of antiseptics like Chlorhexidine not only increase the risk of local and systemic side effects (e.g., mucosal irritation, staining, dysgeusia) but also contribute to the broader concern of microbial resistance and adverse drug interactions, particularly when used concurrently with

systemic medications.

Recommendations

I. Strengthen Continuing Dental Education (CDE): Incorporate modules on rational mouthwash use, drug interactions, and adverse effects into mandatory training programs for GDPs.

II. Develop National or Regional Guidelines: Establish evidence-based clinical guidelines tailored for Chlorhexidine use in Iraqi dental settings, emphasizing clear indications, appropriate dosage, and treatment duration.

III. Promote Pharmacovigilance in Dentistry: Encourage reporting and documentation of Chlorhexidine-related adverse reactions to enhance patient safety and data collection.

IV. Enhance Patient Counseling Protocols: GDPs should inform patients regarding potential side effects, allergic reactions, and the importance of compliance with usage instructions.

V. Interprofessional Collaboration: Encourage coordination between dentists and pharmacists to review prescriptions and mitigate drug interactions, especially for patients on systemic therapies like anticoagulants or lithium.

Future Directions

- Longitudinal Studies: Conduct follow-up studies to evaluate the impact of educational interventions on prescribing behavior and knowledge retention among GDPs.
- Resistance Surveillance: Initiate microbiological research to monitor Chlorhexidine resistance patterns in oral pathogens across clinical settings in Iraq.
- Policy-Level Integration: Advocate for the inclusion of antimicrobial stewardship principles, including antiseptic prescribing, into national oral health strategies.
- Digital Decision-Support Tools: Develop electronic prescribing support systems that guide clinicians with evidence-based prompts on mouthwash indications and contraindications.
- Broader Geographic Assessment: Expand future studies to include GDPs from multiple Iraqi provinces for a more comprehensive national analysis and policy formulation.

Conflict of Interest: The authors declare no conflict of interest.
Financing: The study was performed without external funding.
Ethical consideration: The study was approved by Al-Mustaqbal University, Babylon, Iraq.

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