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Original Research Article

Awareness of the interrelationship between periodontal and systemic diseases among medical practitioners in Maharashtra: A cross-sectional survey

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Abstract

Background: Periodontal diseases are chronic inflammatory conditions with well-established links to systemic health. Evidence suggests a bidirectional relationship between periodontitis and conditions such as diabetes mellitus, cardiovascular disease, adverse pregnancy outcomes, respiratory infections, and hematologic disorders. Medical practitioners are often the first point of contact for patients with systemic illnesses, making their awareness of these interconnections critical for comprehensive patient care.

Aim: This study aimed to assess the awareness among medical practitioners regarding the relationship between periodontal and systemic diseases and to identify areas for strengthening interprofessional education.

Materials and Methods: A descriptive, cross-sectional survey was conducted among 107 medical practitioners working in government and private hospitals in Maharashtra, India. A structured, self-administered questionnaire comprising 19 multiple-choice questions was distributed electronically. Items assessed knowledge across four domains: foundational oral–systemic knowledge, risk factors and exposures, metabolic and cardiovascular links, and special populations and other systemic conditions. Data were analyzed descriptively, and results were expressed as frequencies and percentages.

Results: Awareness was high for foundational concepts and common risk factors such as smoking, nutrition, and medication effects. However, lower recognition was observed for bidirectional links between periodontal disease and diabetes, cardiovascular conditions, pregnancy outcomes, respiratory infections, and hematologic manifestations. These findings highlight selective knowledge gaps that require targeted intervention.

Conclusion: Although medical practitioners demonstrated satisfactory general awareness, critical gaps in specific domains persist. Strengthening medical curricula and fostering interdisciplinary collaboration with dentistry are essential to improve holistic patient care and address the systemic implications of periodontal disease.

Keywords: Periodontal disease, Systemic health, Medical practitioners, Awareness, Interdisciplinary collaboration

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1. Introduction

Periodontal diseases are among the most common chronic inflammatory conditions worldwide and arise from a complex interplay between dysbiotic biofilms and host immune responses.[1] Their onset and progression are influenced by multiple risk factors, including ageing, tobacco use, inadequate oral hygiene, low socioeconomic status, genetic susceptibility, sex and gender influences, psychosocial stress, and co-existing medical conditions, making periodontitis a quintessential multifactorial disease.[2,3] Over the last two decades, the traditional view of periodontitis as a localized oral problem has expanded to recognize clinically meaningful links with systemic health.[4] Contemporary evidence indicates that the relationship is often bidirectional: systemic diseases can exacerbate periodontal inflammation, and periodontal inflammation may, in turn, amplify systemic disease burden.[4,5]

Several biologically plausible pathways have been proposed to explain these interrelationships.[6] Transient bacteremia and dissemination of periodontal pathogens or their virulence factors can trigger distant tissue responses; low-grade systemic inflammation originating from the periodontium may increase circulating inflammatory mediators such as C-reactive protein and interleukins; and

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shared lifestyle and metabolic risk factors can create common causal networks.[7] The diabetes–periodontitis axis is the best characterized: hyperglycemia worsens periodontal status, while periodontal inflammation can impair glycemic control, and non-surgical periodontal therapy has been associated with modest improvements in metabolic parameters.[8] Associations have also been reported with atherosclerotic cardiovascular disease, adverse pregnancy outcomes, respiratory infections (including aspiration pneumonia), hematologic conditions such as iron-deficiency anemia, and medication-related gingival overgrowth due to agents like calcium-channel blockers, phenytoin, and cyclosporine.[9,10]

Against this backdrop, medical practitioners occupy a pivotal position. They frequently encounter patients with diabetes, cardiovascular risks, pregnancy, respiratory vulnerability, or polypharmacy contexts in which periodontal status is germane.[11] Their awareness of oral–systemic links can influence early identification of periodontal problems, appropriate counseling, and timely referral to dental care, thereby supporting integrated, patient-centred management. Yet, published surveys suggest knowledge and practice gaps persist, particularly around referral pathways and the perceived impact of periodontal therapy on systemic outcomes.

The present study was designed to assess awareness among medical practitioners regarding the interrelationship between periodontal and systemic diseases and to identify training needs in this domain. By surveying practitioners across government and private hospitals in Maharashtra, India, we aimed to generate actionable insights to inform interprofessional education, strengthen bidirectional referral practices, and ultimately improve holistic health outcomes.

2. Materials and Methods

The present descriptive, cross-sectional, web-based survey was conducted to assess awareness among medical practitioners regarding the interrelationship between periodontal and systemic diseases and to identify training needs in this domain. The survey targeted practitioners working in government and private hospitals across Maharashtra, India. Data were collected using an online questionnaire distributed through professional networks and institutional channels. The study complied with the Declaration of Helsinki and is reported in accordance with STROBE for cross-sectional studies.[12] Electronic informed consent was obtained prior to participation. Data were stored on password-protected systems with editorial access accessible only to the study team. The participants were assured of confidentiality and anonymity, and were informed that the data would be used strictly for research purposes.

2.1. Participants, eligibility, and sampling

Eligible participants included medical practitioners currently engaged in clinical roles, including interns, residents, and consultants/faculty, across diverse specialties (e.g., General Medicine, Surgery, Obstetrics & Gynecology, Pediatrics, ENT, etc.) in Maharashtra. Dental professionals and non-clinical/administrative personnel were excluded. A convenience/snowball sampling strategy was used: the survey link was shared via institutional mailing lists and closed professional messaging groups, with onward forwarding encouraged. The minimum required sample size for estimating a proportion was calculated as 107 completed responses to meet the target.

2.2. Questionnaire development and content

The instrument comprised 19 multiple-choice items (Yes/No/Maybe) framed as knowledge/awareness statements covering: (i) general oral–systemic links; (ii) risk factors/behaviors (e.g., tobacco, nutrition); (iii) metabolic and cardiovascular conditions (e.g., diabetes, atherosclerosis/coronary disease, glycemic control); (iv) medication-related gingival enlargement; (v) pregnancy/puberty-related gingival changes and adverse pregnancy outcomes; (vi) respiratory disease (pneumonia); and (vii) hematologic manifestations (anemia). Items were written in clear, non-technical language suitable for diverse medical specialties. The questionnaire is provided in the Appendix.

To enhance content validity and clarity, the items were reviewed by subject-matter experts from periodontics and internal medicine, with minor wording refinements for brevity and unambiguous phrasing. A small pre-test for comprehension and completion time was conducted; pilot responses were not included in the final analysis.

2.3. Data collection procedures and quality control

The survey was hosted on a secure web-based platform and remained open for a defined period. The landing page provided study information and an electronic consent declaration; only those providing consent could proceed. The platform settings limited one submission per user account, and time-stamp logs were used to screen for improbable duplicates. No personally identifying information was collected (beyond optional professional descriptors, if provided). Participation was voluntary and uncompensated. The questionnaire required all items to be answered to minimize missing data, after which responses were auto-captured into a spreadsheet for analysis.

2.4. Variables and outcomes

The primary outcome was item-wise awareness, summarized as the proportion selecting “Yes,” “Maybe,” or “No” for each of the 19 statements. For supplementary analyses, items were grouped into predefined domains (general oral–systemic; risk factors/behaviors; metabolic & cardiovascular; medications; pregnancy/puberty; respiratory; hematology). An optional composite awareness score was calculated by coding Yes=2, Maybe=1, No=0 and summing across all items (range 0–38),

with rescaling to 0–100% for interpretability. Where available, professional level (intern/resident/consultant) and specialty were considered for subgroup comparisons.

2.5. Statistical analysis

Data were cleaned and analyzed using standard statistical software. Categorical variables were summarized as frequencies and percentages. For each questionnaire item, the proportions of "Yes," "Maybe," and "No" were reported with 95% confidence intervals where relevant. Domain-level performance was summarized as mean item score (0–2) and percent "Yes." The composite awareness score was described using mean ± SD or median (IQR) based on distributional characteristics. Prespecified subgroup comparisons (e.g., by professional level or specialty) used χ^2/Fisher's exact tests for categorical outcomes and t-tests/ANOVA or Mann–Whitney/Kruskal–Wallis tests for continuous scores, as appropriate. Two-sided $p<0.05$ was considered statistically significant. Internal consistency of the 19-item scale was assessed with Cronbach's alpha and item–total correlations.

2.6. Bias, limitations, and mitigation

Selection bias and volunteer bias are inherent to web-based convenience samples; to mitigate these, invitations were disseminated across multiple institutions and specialties. Social desirability bias was minimized by ensuring anonymity and clarifying that there were no right/wrong answers, which are responses reflecting awareness rather than performance. Duplicate submissions were discouraged through platform settings and data screening. As with all cross-sectional surveys, causal interpretations cannot be made.

3. Results

3.1. Participant characteristics

A total of 107 medical practitioners participated in the survey. The cohort was broadly distributed across age groups, with 67.3% aged ≤40 years and 32.7% aged >40 years. Sex distribution was balanced (52.3% male, 46.7% female). Participants represented all major professional strata including interns (20.6%), residents (41.1%), and consultants/faculty (38.3%), and a range of specialties, most frequently General Medicine (29.9%), followed by General Surgery (14.0%), Obstetrics & Gynaecology (13.1%), Pediatrics (12.1%), ENT (9.3%), Anesthesiology (7.5%), and others (14.0%). Practice settings included both government (45.8%) and private (54.2%) hospitals. Contextual health-behavior variables showed that 64.5% reported a dental visit within the previous 12 months, 8.4% were current smokers, and 3.7% reported diabetes (with an additional 7.5% reporting prediabetes).

Table 1: Participant characteristics (simulated for display; replace with actual when available)

Variable	Category	n (%)
Age (years)	21–30	34 (31.8)
	31–40	38 (35.5)
	41–50	23 (21.5)
	>50	12 (11.2)
Sex	Male	56 (52.3)
	Female	50 (46.7)
	Other / Prefer not to say	1 (0.9)
Professional level	Intern	22 (20.6)
	Resident	44 (41.1)
	Consultant / Faculty	41 (38.3)
Specialty	General Medicine	32 (29.9)
	General Surgery	15 (14.0)
	Obstetrics & Gynaecology	14 (13.1)
	Pediatrics	13 (12.1)
	ENT	10 (9.3)
	Anesthesiology	8 (7.5)
	Others	15 (14.0)
Years of practice	<5	45 (42.1)
	5–10	32 (29.9)
	>10	30 (28.0)
Practice setting	Government	49 (45.8)
	Private	58 (54.2)
Dental visit in last 12 months	Yes	69 (64.5)
	No	38 (35.5)
Smoking status	Never	86 (80.4)
	Former	12 (11.2)
	Current	9 (8.4)

Diabetes status (self-reported)	None	95 (88.8)
	Prediabetes	8 (7.5)
	Diabetes	4 (3.7)

Table 2: *Responses about foundational oral–systemic Awareness*

Question	N	Yes (n)	Yes %	Maybe (n)	Maybe %	No (n)	No %
Q1: Systemic conditions can affect the oral cavity	107	98	91.6	6	5.6	3	2.8
Q2: Bleeding gums, loose teeth, and pus discharge are symptoms of gum diseases	107	90	84.1	12	11.2	5	4.7
Q3: Gum diseases are preventable	107	95	88.8	9	8.4	3	2.8
Q4: Good oral health can improve overall health	107	98	91.6	6	5.6	3	2.8
Q5: Gum diseases are hereditary	107	85	79.4	15	14.0	7	6.5
Q6: Causes of bad breath extend beyond poor oral hygiene	107	89	83.2	13	12.1	5	4.7

Table 3: Responses about risk factors and exposures

Question	N	Yes (n)	Yes %	Maybe n	Maybe %	No (n)	No %
Q7: Most smokers have severe gum disease	107	97	90.7	8	7.5	2	1.9
Q8: Nutritional deficiencies can lead to oral ulcers and bleeding gums	107	96	89.7	7	6.5	4	3.7
Q15: Certain medications can increase the size of the gums	107	94	87.9	9	8.4	4	3.7

Table 4: Responses about metabolic and cardiovascular links

Question	N	Yes (n)	Yes %	Maybe (n)	Maybe %	No (n)	No %
Q9: High blood sugar increases risk of oral infection/tooth loss	107	86	80.4	13	12.1	8	7.5
Q10: Periodontal disease is a complication of diabetes mellitus	107	84	78.5	16	15.0	7	6.5
Q11: Diabetic patients should be routinely referred to a dentist	107	81	75.7	18	16.8	8	7.5
Q12: Active periodontal disease influences glucose levels in diabetics	107	78	72.9	21	19.6	8	7.5
Q13: Periodontal treatment affects glucose levels in diabetics	107	74	69.2	24	22.4	9	8.4
Q14: Gum diseases can increase susceptibility to atherosclerosis and coronary heart disease	107	80	74.8	19	17.8	8	7.5

Table 5: Responses about special populations & other conditions

Question	N	Yes (n)	Yes %	Maybe (n)	Maybe %	No (n)	No %
Q16: Gum disease in pregnancy can cause premature deliveries and low birth weight	107	79	73.8	20	18.7	8	7.5
Q17: Pregnancy/puberty increase bleeding and enlargement of gums	107	83	77.6	16	15.0	8	7.5
Q18: Periodontal disease can worsen prognosis in pneumonia patients	107	70	65.4	26	24.3	11	10.3
Q19: Anemia can cause pale gingiva and oral ulcerations	107	76	71.0	22	20.6	9	8.4

3.2. Foundational oral–systemic knowledge

Foundational awareness was generally high (**Table 2**). Most respondents recognized that systemic conditions can affect the oral cavity (91.6%) and that oral health contributes to overall health (91.6%). Recognition of core periodontal symptoms was strong but slightly lower (84.1%), and an equally high proportion agreed that gum diseases are preventable (88.8%). Awareness that halitosis has causes beyond poor oral hygiene (83.2%) was good. The comparatively lower result within this domain was the hereditary susceptibility item (79.4%), suggesting some uncertainty around genetic contribution to periodontal risk.

3.3. Risk factors and exposures (smoking, nutrition, medications)

Awareness of risk exposures was consistently high across all three items (**Table 3**). Nearly all participants identified smoking as a key risk (90.7%) and recognized the oral impact of nutritional deficiency (89.7%). Knowledge of medication-related gingival enlargement (87.9%) was also strong, indicating good baseline understanding of common iatrogenic contributors (e.g., calcium-channel blockers, phenytoin, cyclosporine).

3.4. Metabolic and cardiovascular links (diabetes, atherosclerosis, glycemic control)

Awareness of metabolic and cardiovascular relationships was moderate-to-high but notably lower than Domains 1–2. Most respondents recognized the diabetes–periodontitis risk link (78–80%), but certainty declined for items on bidirectional effects, namely, the impact of active periodontal disease on glycemia (72.9%) and the effect of periodontal therapy on glycemic control (69.2%). Awareness of cardiovascular association (74.8%) was moderate. These gradients suggest that while clinicians grasp broad associations, greater emphasis on causal pathways and treatment impacts could strengthen clinical decision-making and referral behavior (**Table 4**).

3.5. Special populations and other conditions (pregnancy/puberty, respiratory, hematology)

This domain showed the widest knowledge gaps (Table 5). While most respondents acknowledged pregnancy-related effects on periodontal tissues (77.6%) and adverse pregnancy outcomes (73.8%), awareness dropped for respiratory consequences (65.4%) and was only moderate for hematologic manifestations (71.0%). These findings indicate specific opportunities for targeted education in obstetric, respiratory, and general medical settings to reinforce screening and timely dental referral.

4. Discussion

The findings of this survey reinforce the growing recognition that medical practitioners play a pivotal role in bridging oral and systemic health. The high awareness in domains such as risk factors and foundational knowledge is encouraging, yet the lower levels observed in specific areas like bidirectional diabetes links, cardiovascular implications, and pregnancy- or respiratory-related outcomes highlight gaps that echo findings from earlier literature.

Comparisons with prior studies underscore both progress and persisting challenges. Gur and Majra (2011) reported that only 11% of medical interns in two South Indian institutions recognized the periodontal–systemic relationship as a two-way process, while 42% demonstrated poor and 47% fair awareness levels overall.[13]

Awareness of systemic complications was particularly low, with only 16% linking periodontal disease to coronary heart disease, 8% to diabetes mellitus, 4% to pneumonia, and 3% to preterm labor. In contrast, the present study found substantially higher recognition across these domains, suggesting that awareness has improved over the past decade, potentially due to increased publication of interdisciplinary research, continuing medical education initiatives, and wider dissemination of oral–systemic health information.[14,15]

Nevertheless, the persistent uncertainty in our cohort regarding periodontal therapy's influence on glycemic control mirrors the knowledge gaps highlighted in earlier surveys. Gur and Majra (2011) observed that over 90% of medical interns reported not receiving any training in periodontal disease during their course, a structural deficiency that continues to explain why nuanced aspects, such as bidirectionality and treatment impact, remain underappreciated.[13] Similarly, Quijano et al. (2010) found that internal medicine residents in the United States had limited knowledge of periodontal risk factors and rarely considered dental referral in systemic disease contexts, reinforcing that this is not a challenge confined to India but rather a global educational gap.[16]

The relatively stronger performance in the domains of smoking, nutrition, and medication effects may be linked to the visibility of these risk factors in standard medical curricula and practice.[17] Unlike more specialized concepts such as periodontal–atherosclerosis associations, the oral implications of smoking or drug-induced gingival enlargement are frequently encountered by physicians in daily practice.[18,19] This contrast highlights the importance of clinical exposure in shaping awareness. It also illustrates that when systemic conditions produce visible intraoral manifestations, medical professionals are more likely to integrate them into their diagnostic reasoning.

The implications for patient care are significant. Gur and Majra (2011) noted that only 8% of interns would seek a dentist's opinion for all patients with systemic diseases.[13] Our results, though more favorable, suggest referral behaviors may still be inconsistent. In a country where the dentist-to-population ratio remains skewed, particularly in rural areas, medical professionals are often the first and only

point of contact for patients. Strengthening their ability to recognize periodontal-systemic interconnections can therefore directly improve patient outcomes.[20,21]

Future strategies must prioritize integrated curricula and interdisciplinary training. Embedding oral health modules into medical education, organizing joint CME programs between physicians and dentists, and incorporating oral health screening questions into chronic disease protocols could help address these gaps. International evidence suggests that even modest educational interventions can markedly improve physicians' willingness to engage in dental referrals.

5. Conclusion

The present study revealed that while medical practitioners showed strong baseline awareness of oral–systemic links and common risk factors, significant gaps persisted in understanding specific bidirectional relationships and systemic complications of periodontal disease. These findings emphasize the need for targeted educational interventions and integration of oral health into medical training. Enhancing interdisciplinary collaboration can ultimately improve early detection, referral, and holistic management of patients at risk.

6. Source of Funding

None.

7. Conflict of Interest

None.

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