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Oral health and treatment needs across tribal and non-tribal groups: A tertiary care cross-sectional study

Sonal Saigal[1,*], Saurabh Prasad[2] & V.P.K. Vedha[3]

[1]Department of Oral Pathology, Microbiology and Forensic Odontology, Dental Institute, Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand, India; [2]Department of Conservative Dentistry and Endodontics, Career Post graduate Institute of Dental Sciences and Hospital, Lucknow, India; [3]Department of Public Health Dentistry, Dental Institute, Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand, India; *Corresponding author

Affiliation URL:
https://rimsranchi.ac.in/dept/dentistry.php
https://www.careerdental.in/

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Author contact:
Sonal Saigal - E-mail: drsaigalop@gmail.com; Phone: +91 9723273639
Saurabh Prasad - E-mail: saurabhprasadd@gmail.com
V.P.K. Vedha - E-mail: vedhavpk6@gmail.com

Abstract:
Comparative oral health data for tribal and non-tribal populations in India remain limited, particularly regarding whether disparities reflect disease burden or healthcare access. This cross-sectional study assessed 343 participants (169 non-tribal, 174 tribal) at a tertiary care institution using WHO Basic Oral Health Survey (2013) criteria across three age strata. Overall caries experience differed statistically between the groups, although the absolute difference in mean affected surfaces was small (3.54 versus 3.52) Periodontal pocket (4–5 mm and ≥6 mm) and 4–5 mm attachment loss were significantly greater among tribal participants ($p \leq 0.001$ and $p \leq 0.005$). Prompt treatment, predominantly scaling, was required by a substantial proportion of participants in both groups (78.7% tribal versus 68.6% non-tribal). However, 55.7% of tribal participants had never accessed professional dental care, compared with 32.5% of non-tribal participants ($p=0.027$). Thus, data shows that disparities in dental service utilization may contribute substantially to oral health inequities between tribal and non-tribal populations, alongside differences in periodontal disease burden, underscoring the need for access-focused, community-based interventions.

Keywords: Oral health, tribal population, world health organization (WHO)

Background:
Health is an ecumenical human desideratum for all cultures, which is visually perceived as a reflection of the body and a gateway to it. General health cannot be achieved or maintained without oral health **[1]**. The World Health Organization fact sheet on oral health states, "Oral health contributes directly to general health and quality of life". An individual considered to be in a state of psychiatric wellness should be free of pain in their mouth, throat and jaws, periodontal disease, tooth decay, tooth loss and other conditions that interfere with their ability to chew, bite, smile and speak **[2]**. There is a need for unique approaches to health care for every population group, to study their health problems and explore methods for providing health care **[3]**. Dental professionals should evaluate the oral health of older individuals including their abilities and signs of illness. Based on each patient's health status and personal preferences, the care must be appropriate. An obviation plan should be individualized for each patient and ideally discussed with adult patients before their later years **[4]**. Estimation of dental diseases and their demographic characterization would facilitate the administration to the border of policies for oral health. Nowadays, it is necessary to improve access to general and specialty dental services in both the public and private sectors **[2]**. Access to healthcare for tribal populations in India remains a critical challenge. This crisis stems from socio-economic vulnerabilities, geographical isolation and inadequate healthcare infrastructure. Furthermore, the shortage of dental professionals, lack of specialized equipment, linguistic barriers and prolonged wait times at health centres further restrict care. Consequently, tribal communities lag significantly behind other social groups across various social, health and developmental indices **[5]**. Since independence, the government has worked on developing tribal communities to help them compete with non-tribal areas through various programs and schemes **[6]**. Considering these facts, it's important to assess the oral health differences between tribal and non-tribal people, educate them about oral health and encourage them to improve their oral hygiene early in life. To the best of my erudition, there hasn't been a comparison between the dental health of tribal and non-tribal people. This could help build a database for oral health planners to choose cost-effective preventive and curative measures. The present study aimed to assess and compare the oral health differences and treatment needs of tribal and non-tribal people using the WHO criteria for basic oral health surveys from 2013 **[7]**. Therefore, it is of interest to evaluate the relationship between dental health outcomes and factors like bad habits, diet and oral hygiene practices.

Materials and Methods:
This study complied with the protocol; ethical approval was obtained from the Institutional Ethical Committee (IEC registration No. 769/INST/JH/2015/RR-21) vide approval Letter No. 76, dated 17/6/2022. This study used a cross-sectional approach with random sampling to select participants. This cross-sectional study used simple random sampling to recruit participants, stratified into three age groups: 15–19, 35–44 and 65–74 years. Sample size was calculated for a single population proportion ($n = Z^2PQ/d^2$), based on prevalence estimates from prior studies Haque *et al.* **[8]** and Kumar *et al.* **[9]** reported 61.2% good and 38.8% poor oral hygiene among tribal populations, while Janakiram *et al.* **[10]** found a 51% prevalence of periodontal and hygiene issues in the general Indian population. Applying a relative precision of 10% and a 95% confidence level (Z=1.96), the minimum required sample size was 166. The final sample exceeded this threshold in both groups, comprising 343 participants with 169 non-tribal (15–19 years, n=59; 35–44 years, n=57; 65–74 years, n=53) and 174 tribal (15–19 years, n=60; 35–44 years, n=60; 65–74 years, n=54). The study was conducted from June 22 to August 22, 2022 after receiving ethical approval from the institution and permission from the relevant authorities. All participants were informed about the study's purpose and procedures. Written informed consent was obtained from participants aged 18 years and above, while for participants aged 15–17 years, written informed consent was obtained from a parent or legal guardian, along with the minor's assent.

Participant information was kept confidential throughout the study. Data collection instrument and procedure-before starting the study, a standardization process was carried out to help the researcher understand the survey methods and how to record information properly. This helped ensure that everyone involved interpreted and applied the diagnostic criteria and codes consistently. All the examinations during the study were done by one examiner to avoid differences in results. After getting informed consent, participants were interviewed using a questionnaire that had been tested beforehand. The questionnaire covered four main areas: socio-demographic details, deleterious habits, dietary practices and oral hygiene practices. All participants were examined while sitting upright in a dental chair with armrests. The clinical exams followed the guidelines set by the American Dental Association, using flat mirrors and community periodontal index (CPI) probes to check for periodontal issues, all under good natural light. The oral health of each person was assessed using the World Health Organization's Oral Health Assessment Tool from 2013 **[7]**, which are widely recognized for evaluating the oral health and dental needs of different populations. All assessment forms were duly filled for extra-oral examination, temporomandibular joint assessment, oral mucosal conditions, enamel opacities and hypoplasia, dental fluorosis, dentition status, prosthetic status and needs, dentofacial anomalies, need for immediate care and referral for required treatment **[7]**. Inclusion criteria comprised individuals with permanent dentition within the age ranges of 15–19, 35–44 and 65–74 years, classified as tribal or non-tribal based on available records and self-reported community affiliation. Exclusion criteria included individuals unwilling to participate; those with cognitive or physical impairment precluding informed consent or clinical examination; individuals with systemic conditions that could compromise safety or data quality; individuals with deciduous or mixed dentition; and pregnant women. Descriptive statistics summarized all study variables; associations between categorical variables were assessed using the chi-square test, while independent t-tests were applied for continuous variables. Statistical significance was set at $P < 0.05$.

Results:

The present study aimed to assess and compare oral health status and treatment needs among tribal and non-tribal using the World Health Organization Basic Oral Health Survey Methods (2013). The final study population consisted of 343 participants, comprising 169 non-tribal and 174 tribal subjects. The mean age of participants in the non-tribal and tribal groups was 40.14 ± 20.62 years and 40.12 ± 20.86 years, respectively. Females constituted more than half of the study population in both groups, accounting for 56.8% of non-tribals and 60.3% of tribals. Socioeconomic status assessment revealed that the majority of non-tribal participants belonged to the lower middle class (48.5%), whereas most tribal participants belonged to the upper lower class (41.4%). With respect to place of residence, 95.9% of non-tribals and 80.5% of tribals resided in urban areas. The differences in demographic characteristics between the two groups were not statistically significant **(Table 1).** Dentition status among non-tribal and tribal participants was assessed using the WHO (2013) proforma and the findings are presented in **(Table 2).** The mean number of tooth surfaces affected by dental caries was 3.52 ± 4.47 in the non-tribal group and 3.54 ± 2.87 in the tribal group, with the difference being statistically significant ($P = 0.020$). On assessing proximal caries, the mean number of proximal surfaces affected was 0.88 ± 1.97 among non-tribals and 0.64 ± 1.25 among tribals and this difference was also statistically significant ($P = 0.017$). Periodontal assessment revealed statistically significant differences between the two groups in the mean number of teeth affected by pocket depth of 4–5 mm and ≥6 mm (both $P < 0.001$) and loss of attachment of 4–5 mm ($P = 0.005$). Treatment urgency, presented in (Table 3), showed that the majority of participants required prompt treatment, including scaling, in both tribal (78.7%) and non-tribal (68.6%) groups, with no statistically significant difference between groups ($P = 0.903$). Oral hygiene practices were comparable between groups, with 96.3% of non-tribal and 98.3% of tribal participants reporting once-daily toothbrushing (no statistically significant difference). Dental care-seeking behavior, however, diverged sharply while less than one-third of non-tribal participants (32.5%) had never accessed professional dental care, this proportion rose to more than half of tribal participants (55.7%), a statistically significant difference ($P = 0.027$) that underscores the utilization gap central to this study's findings. Among tribal participants who had sought care, pain or gum-related symptoms were the predominant reason for the visit (43.1%), reflecting a largely reactive rather than preventive pattern of care-seeking ($P = 0.043$). Dietary habits also differed significantly between groups, with lower consumption of fresh fruits ($P = 0.026$) and higher intake of cariogenic foods such as biscuits ($P = 0.002$) and cakes/sweets ($P < 0.001$) among tribal participants.

Table 1: Demographic characteristics of the study population

Characteristics		Non-tribal			Tribal			p value
		15-19 years – n=59	35-44 years – n=57	65-74 years – n=53	15-19 years- n=60	35-44 years – n=60	65-74 years – n=54	
Age (Mean ± SD)		16.73±0.925	39.37±2.756	67.04±2.130	16.75±1.348	39.60±3.021	67.78±2.859	0.824
Gender [n(%)]	Male	5(8.5)	30(52.6)	38(71.7)	6(10)	36(60)	27(50)	0.210
	Female	54(91.5)	27(47.4)	15(28.3)	54(90)	24(40)	27(50)	
Socio-economic status [n(%)]	Lower	-	3(5.3)	5(9.4)	-	1(1.7)	9(16.7)	0.210
	Upper lower	12(20.3)	9(15.8)	17(32.1)	33(55)	20(33.3)	19(35.2)	
	Lower middle	47(79.7)	16(28.1)	19(35.8)	27(45)	22(36.7)	16(29.6)	

	Upper middle	-	29(50.9)	12(22.6)	-	17(28.3)	16(35.2)	
	Upper	-	-	-	-	-	10(18.5)	
Location [n(%)]	Urban	59(100)	54(94.7)	49(92.5)	59(98.3)	52(86.7)	29(53.7)	0.972
	Peri-urban	-	-	1(1.9)	-	3(5.0)	4(7.4)	
	Rural	-	3(5.3)	3(5.7)	1(1.7)	5(8.3)	21(38.9)	

Values are presented as mean ± standard deviation or number (percentage).

Table 2: Dentition status of the study population

Characteristics		**Non-tribal**			**Tribal**			**P value**
		15-19 years – n=59	35-44 years – n=57	65-74 years – n=53	15-19 years- n=60	35-44 years – n=60	65-74 years – n=54	
Mean surfaces affected by caries		2.98±3.521	3.19±4.438	4.47±5.312	3.30±2.331	3.18±3.186	4.20±2.968	0.020[a]
Mean proximal surfaces affected by caries		0.29±1.415	0.88±2.027	1.53±2.250	0.32±0.813	0.60±1.167	1.06±1.595	0.017[a]
Mean surfaces filled due to caries		0.02±0.130	0.07±0.530	0	0	0	0.04±0.272	0.176
Mean surfaces filled without caries		0	0.07±0.371	0.11±0.423	0.08±0.645	0.02±0.129	0	0.216
Mean missing tooth due to caries		0.07±0.365	1.05±2.074	2.51±3.148	0.20±0.514	0.63±1.149	3.04±2.525	0.821
Mean missing tooth due to any reason except caries		0	0.12±0.426	1.74±4.360	0	0.48±1.909	1.04±2.599	0.437
Mean unerupted teeth		3.15+1.4	0.25+0.763	0	3.03+1.529	0.22+0.825	0	0.905
Mean tooth positive for bleeding on probing		3.83±3.601	9.39±5.728	13.79±6.147	6.92±3.946	9.12±6.512	16.78±6.108	0.481
Mean number of teeth with Pocket depth	4-5mm	0.34±0.779	2.86±4.211	3.77±3.244	0.77±1.731	1.52±2.425	9.63±6.904	<0.001
	6mm or more	0	0.09±0.474	1.64±2.788	0	0.85±2.313	2.48±3.975	<0.001
Mean number of teeth with Loss of attachment	4-5mm	0.19±0.434	0.91±1.272	1.87±1.316	0.30±0.619	0.68±0.948	2.70±1.525	0.005[a]
	6-8mm	0	0.07±0.320	1.00±1.544	0	0.53±1.346	0.70±1.143	0.292
Dental fluorosis	Normal	58(98.3%)	57(100%)	53(100%)	59(98.3)	60(100)	54(100)	0.938
	Questionable	1(1.7%)	-	-	-	-	-	
	Very mild	-	-	-	1(1.7)	-	-	
	Mild	-	-	-	-	-	-	
	Moderate	-	-	-	-	-	-	
	Severe	-	-	-	-	-	-	
Erosion	Present	-	-	-	-	-	-	-
	Absent	59(100)	57(100)	53(100)	60(100)	60(100)	54(100)	
Number of teeth affected by trauma	Nil	59(100)	54(94.7)	51(96.2)	60(100)	60(100)	54(100)	-
	1 tooth	-	2(3.5)	1(1.9)				
	2 teeth	-	1(1.8)	1(1.9)				
	Absent	58(98.3)	56(98.2)	52(98.1)	60(100)	60(100)	53(98.1)	

[a]*Statistically significant difference between groups; WHO Oral Health Assessment Tool (2013) criteria used*

Table 3: Need or urgency of oral health intervention of the study population

Characteristics		**Non-tribal**			**Tribal**			**P value**
		15-19 years – n=59	35-44 years –n=57	65-74 years –n=53	15-19 years- n=60	35-44 years – n=60	65-74 years – n=54	
Need of intervention or urgency	No Treatment needed	4(6.8)	1(1.8)	-		2(3.3)	-	0.903
	Preventive or routine Treatment needed	17(28.8)	2(3.5)	1(1.9)	6(10)	5(8.3)	-	
	Prompt Treatment needed	35(59.3)	40(70.2)	41(77.4)	54(90)	42(70)	41(75.9)	
	Immediate Treatment needed due to pain or infection of dental or oral origin	2(3.4)	14(24.6)	11(20.8)	-	11(18.3)	13(24.1)	
	Referred for comprehensive evaluation or medical Treatment	1(1.7)	-	-	-	-	-	

Discussion:

Conducting oral health assessments in marginalized tribal groups is vital for the formulation of comprehensive health care and oral health education strategies to enhance oral health. Access to general and oral care services is often severely limited for these communities. Initiating a focused research program on oral health can help mitigate this disparity. A total of 343 individuals (169 non-tribal and 174 tribal) were surveyed. The mean age of the participants was 40.14 ± 20.62 years in the non-tribal group and 40.12 ± 20.86 years in the tribal group, with participants distributed across the age ranges of 15–19, 35–44 and 65–74 years. More than half of the study subjects were females in both groups (56.8% in the non-tribal and 60.3% in the tribal group), which is consistent with findings from recent studies **[11–13]**. Regarding socio-economic status, the majority of non-tribal participants (48.5%) belonged to the lower middle class, whereas the majority of tribal participants (41.4%) belonged to the upper lower class. Location-wise, 95.9% of non-tribals and 80.5% of tribals resided in urban areas. The differences in demographic characteristics between the non-tribal and tribal groups were not statistically significant. Low tribal literacy is considered a major contributor to socio-economically marginalized communities, a pattern reflected in the present findings and consistent with Kujur and Das **[14]**, as well as studies by Satpati *et al.* (2025) **[15]** and Ratre *et al.* (2026) **[11]**. Study participants were asked about dental health status related to age, oral hygiene and dental visit practices. Given our findings of significant correlations between caries, periodontal

health and several independent variables, future programs could be designed to improve oral hygiene practices and consequently oral health. In the present study, the mean number of surfaces affected by dental caries was 3.52±4.47 in the non-tribal population and 3.54±2.87 in the tribal population and the difference was statistically significant (p=0.020). Specifically assessing proximal caries, the mean number of proximal surfaces affected was 0.88±1.97 and 0.64±1.25 among the non-tribal and tribal groups respectively and this difference was also statistically significant (p=0.017). This was in accordance with the findings of Kumar *et al.* **[9]**. Consistent observations have been reported in recent studies, such as Sarmah *et al.* **[16]**, who found a pooled dental caries prevalence of 44.7% among Indian tribal communities and Gopika *et al.* **[17]**, who reported a mean DMFT of 13.1 ± 5.56 among the Narikuravar tribes and Kalaivani *et al.* **[18],** who reported higher DMFT scores of 13.1 ± 5.56 and 18.32 ± 8.12 respectively among the Narikuravar and Particularly Vulnerable Tribal Groups (PVTGs) in South India. These findings are further supported by an age-stratified household survey of 877 tribals in northern Bhubaneswar, Odisha, which reported a dmft of 4.13±0.73 in 2–5 year, rising progressively to a DMFT of 5.32±2.36 in the 35–44 year age group and 7.56±4.29 in the 65–74-year age group, with a statistically significant age-related increase across all groups except the 65–74 age group Kumar *et al.* **[19].** This cumulative, largely untreated pattern of caries progression with age closely mirrors the trend observed in the present study and reinforces the notion that tribal populations across geographically and culturally distinct regions of India share a common trajectory of unmet restorative care needs. A recent systematic review synthesizing 21 studies across Tamil Nadu, Kerala, Karnataka andhra Pradesh and Telangana similarly reported DMFT scores ranging from moderate to alarmingly high (up to 18.32), with caries prevalence reaching as high as 89.3% among tribal school children as reported by Kumaraguru *et al.* **[20]**. Taken together, these findings suggest that the elevated caries burden observed in the tribal group in the present study is not an isolated or region-specific finding but reflects a broader, systemic pattern of dental neglect among Indian tribal populations. It can be hypothesized that the higher rates of dental caries observed may be due to adverse lifestyle outcomes and greater access to caries-causing foods and beverages among these tribes. The present study shows that participants suffer from various forms of periodontal disease as assessed by the Community Periodontal Index. The mean number of teeth affected by pocket depth of 4–5 mm, pocket depth of 6 mm or above and loss of attachment of 4–5 mm showed statistically significant differences between the non-tribal and tribal groups (p=0.000, 0.000 and 0.005 respectively). This finding is comparable to the findings of the study by Peterson and Razanamihaja **[21]** (91%) on Malagasy tribes in Madagascar. It can be hypothesized that the higher rates of periodontal disease observed in the tribal population may be attributed to adverse lifestyle factors and increased access to cariogenic foods and beverages. These findings are comparable to recent studies conducted among Indian tribal communities. For instance, Pandian *et al.* **[22]** reported a high prevalence of periodontal disease among the Kota tribes in the Nilgiris, with a significant proportion showing shallow and deep periodontal pockets on CPI assessment. Similarly, Thakur and Mohan **[23]** observed poor periodontal health status with high CPI scores among Santhal tribal populations, highlighting widespread calculus, bleeding and pocket formation. A comparable age-graded pattern of periodontal deterioration has also been documented among tribals in northern Bhubaneswar, Odisha, where bleeding gums and shallow pockets were predominant among 35–44-year-olds (mean 1.03±0.08 and 1.64±0.11 sextants respectively), while deep pockets became predominant in the 65–74-year age group (0.65±0.17 sextants) Kumar *et al.* **[19]**, The consistency of this trajectory from gingival inflammation and shallow pockets in middle age to deeper pockets and attachment loss in the elderly across tribal populations in different states suggests that periodontal deterioration in these communities follows a broadly predictable, cumulative course driven by long-term plaque and calculus exposure rather than region-specific factors. The author related the lower prevalence of periodontal disease among the Toda tribe to the fact that they consumed large amounts of vegetables, tubers and roots, which might have a self-cleansing effect on the teeth. As documented by Kumar *et al.*, reports from other from other South Indian tribal populations indicate a heavy reliance on non-standard cleaning methods: in the Odisha household survey, 67.27% of tribal participants used a twig for cleaning their teeth and only 14.25% used a toothbrush **[19]**. Among tribal gypsy populations of Tamil Nadu, the picture was even starker 60.7% used no material at all to clean their teeth, only 2.2% used a toothbrush and while 67.4% brushed once daily, 30.1% did not brush at all, as observed by Pradeep *et al.* **[24],** Where toothbrushes were used, replacement was driven almost entirely by visible bristle fraying rather than any fixed interval, indicating an absence of preventive orientation in oral hygiene behavior even among those who had adopted a toothbrush. These patterns of infrequent brushing and reliance on non-standardized cleaning aids offer a plausible behavioral explanation for the elevated periodontal indices observed in the tribal group of the present study and point to toothbrushing frequency and technique as a modifiable target for future interventions. Beyond structural and behavioral barriers, cultural and psychological determinants also shape tribal treatment-seeking behavior. Using a Health Belief Model framework, Pradeep *et al.* **[24]** found that tribal gypsies in Tamil Nadu rated dental disease severity and the benefits of care highly yet perceived few barriers and little overall importance a combination the authors suggested paradoxically increases cues for action. This favorable attitude profile did not translate into utilization: fatalism (illness as unchangeable and purposeful) and stoicism (silent endurance of pain as dignity) emerged as key psychosocial barriers, alongside self-reliance, with nearly a quarter of the population self-treating dental problems rather than consulting a dentist. Similar home-remedy-first behavior has been echoed elsewhere among South Indian tribal groups, suggesting that knowledge-based awareness campaigns alone are unlikely to succeed unless they also address these underlying cultural belief systems. This is consistent with a

recent systematic review of oral health among South Indian tribal populations **[20]**, which called for culturally competent, community-engaged intervention models including integration of oral health services into primary healthcare and tribal welfare frameworks, capacity-building of grassroots health workers such as ASHAs and Anganwadi staff to deliver basic oral health screening and a shift in future research priorities from purely descriptive prevalence studies toward longitudinal, interventional designs that evaluate the effectiveness of culturally tailored programs over time. It is the first study in this space that evaluates and compares the oral health disparities and treatment needs of tribals and non-tribals. However, even though this new and promising approach is valuable, there is still a long way to go before it becomes fully integrated into broader research and practice. There were several limitations to this study. First, it was a cross-sectional study, which means it cannot establish cause-and-effect relationships. Second, the participants were selected from just one institution, which may lead to selection bias and make it difficult to generalize the findings to a wider population. Future research could explore similar issues in different rural areas across various states or within the same state. Therefore, the conclusions of this study should not be applied to the entire population of the region studied. A longitudinal study would provide more accurate results. Third, the oral health data was collected through self-reports, which reflect the participants' own perceptions and may be influenced by biases such as social desirability or tendencies to give extreme or average responses. Nonetheless, within these constraints, the study provides useful information on dietary habits, oral hygiene practices and the condition of dental and soft oral tissues among the group studied.

Conclusion:

Although treatment needs predominantly scaling were statistically comparable between tribal and non-tribal participants, tribal participants showed modestly but significantly greater overall caries experience and periodontal disease burden. Strikingly, 55.7% of tribal participants had never accessed professional dental care, compared with 32.5% of non-tribal participants, suggesting that disparities in healthcare utilization, rather than disease severity alone, are the more consequential driver of oral health inequity in this population. Poor oral hygiene practices and inconsistent use of conventional dental aids may partly explain the disease burden observed in both groups; however, structural barriers such as cost, geographic distance and low oral health awareness likely account disproportionately for reduced care-seeking among tribal communities. These findings support the need for a state-wide longitudinal study to characterize access barriers more systematically and inform equitable oral healthcare delivery models for tribal populations.

Advancement to Knowledge:

This study advances public health knowledge by providing baseline empirical data on oral healthcare utilization disparities between tribal and non-tribal populations using standardized WHO (2013) methodologies. While clinical treatment needs for conditions like scaling remain similarly high across both groups, this research highlights a critical gap in healthcare access, showing that 55.7% of the studied tribal population had never utilized professional dental services during their lifetime. These findings shift the academic focus toward addressing systemic barriers to oral healthcare access and dental awareness in underserved communities.

Conflict of interest:

No potential conflict of interest relevant to this article was reported.

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