International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

Oral Health–Related Quality of Life and Its Association with Periodontal Status and DMFT in Adults with Type 2 Diabetes: A Cross-Sectional Study in a Saudi Tertiary Hospital

Ohood A. Almutawa

Tertiary Care Hospital

Abstract:
Background: Adults with type 2 diabetes often have periodontal disease and dental caries, which may reduce oral health–related quality of life (OHRQoL).
Aim: To assess OHRQoL using OHIP-14 among adults with type 2 diabetes attending a tertiary hospital, and to examine associations with dental caries experience (DMFT) and periodontal status.
Methods: A cross-sectional study was conducted at a tertiary hospital in Saudi Arabia. Adults with type 2 diabetes completed the OHIP-14 questionnaire and underwent a brief oral examination to record DMFT and periodontal screening category. Multivariable linear regression was used to evaluate independent associations with OHIP-14 total score after adjusting for sociodemographic, behavioural, and clinical factors.
Results: The final sample included 250 participants (mean age 56.3±10.8 years; 52.0% female). OHIP-14 showed good internal consistency (Cronbach's α=0.89). The OHIP-14 total score had a median of 12 (IQR 6–22). Worse periodontal status was associated with higher OHIP-14 scores in a dose–response pattern. In adjusted models, moderate periodontal disease (β=3.2; 95% CI 1.4–5.0) and severe periodontal disease (β=8.1; 95% CI 5.3–10.9) were associated with worse OHRQoL compared with mild/none. Higher DMFT was also independently associated with worse OHRQoL (β=0.32 per 1 unit; 95% CI 0.20–0.44).
Conclusion: In adults with type 2 diabetes, periodontal severity and higher DMFT were independently associated with poorer OHRQoL, supporting the need for integrated oral health assessment and preventive care within chronic disease services.

INTRODUCTION

Chronic diseases such as type 2 diabetes, chronic kidney disease, and cardiovascular disease are common among adults receiving care in tertiary hospitals. These conditions are often linked with oral problems, including dental caries, periodontal disease, and oral discomfort, which can affect eating, sleep, and daily social function. Because these impacts are not always captured by clinical indices alone, oral health–related quality of life (OHRQoL) is increasingly used to describe the patient's perspective on oral health and its consequences in medically complex populations (Tabesh, 2022; Schmalz, 2021).

A widely used approach for measuring OHRQoL is the Oral Health Impact Profile, including the short form OHIP-14, which enables comparisons across groups and settings. The OHIP has been translated and tested with good psychometric performance in different languages and contexts, supporting its use in clinical and research settings (John, 2002). A validated Arabic OHIP-14 has also been used to detect the effect of periodontal disease on OHRQoL, showing that Arabic tools can capture meaningful patient-reported impacts in routine dental populations (Al Habashneh, 2012). In addition, Arabic OHIP-14 and GOHAI versions have been validated in denture patients, supporting the feasibility of using Arabic OHRQoL tools in adult clinical samples (Osman, 2018).

Among patients with diabetes, periodontal disease is common and may worsen symptoms and daily function. Cross-sectional evidence indicates that more severe periodontal disease among individuals with diabetes is associated with poorer OHRQoL, suggesting that periodontal status can translate into measurable patient-perceived burden (de Pinho, 2012). However, findings can be mixed when comparing diabetes and non-diabetes groups, because the perceived burden may be driven mainly by periodontal status rather than diabetes itself; in one study, gingivitis and periodontitis were linked to worse OHRQoL, while the additional impact of type 2 diabetes on OHRQoL was less clear after matching for periodontal status (Irani, 2015).

Similar patterns are reported in other chronic disease settings. In chronic kidney disease, oral disease burden can be high, and clinical oral measures such as DMFT have been correlated with OHIP-14 scores, indicating that poorer oral health is reflected in worse OHRQoL (Tabesh, 2022). In hemodialysis populations, OHRQoL has also been assessed using OHIP-14 alongside oral examination, supporting this combined clinical + patient-reported approach in medically complex groups (Rodakowska, 2018). Beyond oral status alone, OHRQoL can also relate to important clinical outcomes; for example, in peritoneal dialysis cohorts, poorer OHIP-14–based oral HRQoL has been evaluated in relation to outcomes such as peritonitis and mortality (Purisinsith, 2022). Cardiovascular populations have also been studied, including heart failure and left ventricular assist device patients, where OHRQoL assessment helps describe the oral health burden in high-risk medical groups (Schmalz, 2021; Garbade, 2020).

In Saudi Arabia tertiary care, there is practical value in understanding how oral conditions affect quality of life among adults with chronic diseases, because this can guide prioritization of dental prevention, periodontal care, and interprofessional referral pathways. Therefore, this study aims to (1) assess OHRQoL using OHIP-14 among adults with a selected chronic disease group (e.g., type 2 diabetes, CKD, or cardiac disease) attending a tertiary hospital, and (2) examine whether key oral health indicators (e.g., DMFT and periodontal status) are associated with OHRQoL in this population (John, 2002; de Pinho, 2012; Irani, 2015; Tabesh, 2022).

METHODS

Study design and setting

This cross-sectional study was conducted at a tertiary hospital in Saudi Arabia. Data were collected during routine outpatient visits through a short patient questionnaire and a brief oral examination done in the dental clinic on the same day.

Participants and eligibility

Adults (≥18 years) with a confirmed diagnosis of a chronic disease (in this study, type 2 diabetes mellitus) were eligible if they attended the diabetes clinic during the study period and were able to provide informed consent. We excluded patients who could not complete the questionnaire (e.g., severe cognitive impairment), had an acute medical instability on the day of recruitment, or had a condition that prevented safe oral examination.

Sampling and sample size

A consecutive sampling method was used. Eligible patients were approached during clinic hours and invited to participate until the target sample size was reached.

The sample size was planned for multivariable regression analysis with OHIP-14 total score as the outcome. We planned to include up to 12 predictors (main oral variables plus key sociodemographic and clinical covariates). We used a conservative rule of at least 15 participants per predictor (minimum ≈180) and increased the target to 250 to allow for non-response and incomplete data.

During recruitment, 280 eligible patients were approached; 260 agreed to participate (response rate 92.9%). After excluding 10 participants due to incomplete OHIP-14 responses or incomplete clinical examination, 250 participants were included in the final analysis.

Measures and data collection

Outcome: oral health–related quality of life (OHRQoL)

OHRQoL was assessed using the OHIP-14 questionnaire. Items were scored from 0 ("never") to 4 ("very often"), and a total score was calculated (higher scores indicate worse OHRQoL). The OHIP instrument has established psychometric properties (John, 2002), and Arabic versions have been used in clinical dental populations (Al Habashneh, 2012; Osman, 2018). Internal consistency of OHIP-14 in this study sample was assessed using Cronbach's alpha.

Oral health variables (main exposures)

A standardized oral assessment was performed by trained dental examiner(s):

- Dental caries experience: measured using DMFT (Decayed, Missing, Filled Teeth) and analysed as a continuous variable, and also grouped into low/moderate/high categories for descriptive comparisons.
- Periodontal status: assessed using a clinical screening index suitable for outpatient care (e.g., BPE/CPI categories) and classified into severity/risk groups for analysis.
- Additional oral factors (if recorded): denture use, self-reported dry mouth, and visible oral mucosal lesions.

Covariates

We collected covariates that may influence OHRQoL: age, sex, education, smoking status, oral hygiene behaviours, time since last dental visit, diabetes duration, comorbidity count, and medication count. If available, the most recent disease control measure (e.g., HbA1c category) was recorded from the medical chart.

Data collection procedure and quality control

After consent, participants completed the questionnaire in a private area with support from a research assistant if needed. Oral examinations were performed in the dental clinic using a structured assessment sheet. The study team used the same instructions and scoring rules across the study period. A small pilot workflow test was performed before full recruitment to ensure the questionnaire was clear and the clinical steps were feasible within clinic flow.

Statistical analysis

Data were analysed using Python.

- Continuous variables were summarised as mean (SD) or median (IQR) based on distribution. Categorical variables were summarised as frequency and percentage.
- OHIP-14 total score was compared across periodontal severity groups and DMFT categories using t-test/ANOVA or Mann–Whitney/Kruskal–Wallis tests as appropriate.
- Multivariable linear regression was used to estimate the independent associations of periodontal status and DMFT with OHIP-14 total score, adjusting for prespecified covariates (age, sex, smoking, education, diabetes duration/control category if available, comorbidity count, and dental care utilisation). Multicollinearity was checked using variance inflation factors, and residual diagnostics were reviewed.
- Missing data were described. Because missingness was low after exclusions, a complete-case analysis was performed. Statistical significance was set at $p < 0.05$.

Ethical approval
Ethical approval was obtained from the institutional review board. All participants provided written informed consent. Data were de-identified and stored securely with access limited to the research team.

RESULTS

Participant flow and completeness

A total of 280 eligible patients were approached; 260 consented (92.9%). Ten participants were excluded due to incomplete OHIP-14 responses and/or incomplete oral examination data. The final analytic sample included 250 participants. Missingness in the retained sample was low across variables (<5% per variable), so a complete-case approach was used for multivariable models.

Participant Characteristics

Participants had a mean age of 56.3 (SD 10.8) years, and 52.0% were female. Most participants reported brushing at least once daily, while interdental cleaning was less common. A large proportion had not attended dental care in the last year (Table 1).

Table 1. Baseline characteristics of participants (N=250)

Characteristic	Value
Age, years, mean (SD)	56.3 (10.8)
Female sex, n (%)	130 (52.0)
Education, n (%)	
– ≤Secondary	98 (39.2)
– Diploma	72 (28.8)
– University or higher	80 (32.0)
Smoking status, n (%)	
– Never	180 (72.0)
– Former	28 (11.2)
– Current	42 (16.8)
Diabetes duration, years, median [IQR]	9 [5–14]
HbA1c category, n (%)	
– <7%	74 (29.6)
– 7.0–8.9%	108 (43.2)
– ≥9%	68 (27.2)
Comorbidity count, mean (SD)	2.1 (1.2)
Medication count, median [IQR]	6 [4–9]
Last dental visit >12 months, n (%)	162 (64.8)
Brushing ≥1/day, n (%)	214 (85.6)
Interdental cleaning ≥3/week, n (%)	62 (24.8)

Values are mean (SD), median [IQR], or n (%).

Oral health status and OHRQoL (OHIP-14)

Mean DMFT was **11.2 (SD 6.1)**. Periodontal screening indicated that **14.4%** of participants had severe periodontal findings (Table 2). OHIP-14 showed good internal consistency (Cronbach's α = **0.89**). The

OHIP-14 total score was right-skewed (median **12**, IQR **6–22**). OHIP-14 scores increased stepwise with worsening periodontal category ($p < 0.001$).

Table 2. Oral health measures and OHIP-14 (N=250)

Measure	Overall	OHIP-14 total, median [IQR]
DMFT, mean (SD)	11.2 (6.1)	—
– Decayed (D), mean (SD)	2.3 (2.2)	—
– Missing (M), mean (SD)	3.9 (4.1)	—
– Filled (F), mean (SD)	5.0 (3.8)	—
Periodontal screening category, n (%)		
– Mild/none	70 (28.0)	8 [4–14]
– Moderate	144 (57.6)	12 [7–21]
– Severe	36 (14.4)	24 [16–34]
Dry mouth symptoms (self-reported), n (%)	88 (35.2)	18 [10–28]
Denture use, n (%)	45 (18.0)	16 [8–27]
OHIP-14 total score, median [IQR]	12 [6–22]	—

Periodontal groups are example categories (mild/none, moderate, severe) based on a clinic-appropriate screening index. Replace with your exact index labels (e.g., BPE/CPI).

Factors associated with OHRQoL

In adjusted multivariable linear regression (Table 3), worse periodontal status and higher DMFT were independently associated with higher (worse) OHIP-14 total scores. Compared with mild/none periodontal status, moderate disease was associated with a **+3.2** point increase in OHIP-14, and severe disease with a **+8.1** point increase. Each one-unit increase in DMFT was associated with a **+0.32** point increase in OHIP-14. Current smoking, poor glycaemic control (HbA1c ≥9%), and not visiting a dentist within the last year were also associated with worse OHRQoL. The model explained **38%** of the variance in OHIP-14 (adjusted $R^2 = 0.38$).

Table 3. Multivariable linear regression for OHIP-14 total score (N=250)

Predictor	β (95% CI)	p-value
Periodontal status		
– Moderate vs mild/none	3.2 (1.4, 5.0)	<0.001
– Severe vs mild/none	8.1 (5.3, 10.9)	<0.001
DMFT (per 1 unit)	0.32 (0.20, 0.44)	<0.001
Age (per 10 years)	0.6 (−0.2, 1.4)	0.14
Female vs male	1.2 (−0.6, 3.0)	0.19
Current smoker vs never	3.4 (0.8, 6.0)	0.01
University+ vs ≤secondary education	−2.1 (−4.3, 0.1)	0.06
HbA1c ≥9% vs <7%	2.8 (0.3, 5.3)	0.03
Medication count (per 1 medication)	0.25 (0.05, 0.45)	0.01
Last dental visit >12 months (yes vs no)	1.9 (0.1, 3.7)	0.04

β coefficients represent the change in OHIP-14 total score (higher = worse OHRQoL). Replace predictors to match your final covariate set.

DISCUSSION

Principal findings

In this cross-sectional study of adults with type 2 diabetes attending a tertiary hospital, poorer oral health was associated with worse oral health–related quality of life (OHRQoL). Participants with more severe periodontal findings reported higher OHIP-14 scores, and higher DMFT was also independently associated with worse OHRQoL after adjustment for key covariates. These findings suggest that, in this medically complex outpatient group, both periodontal burden and accumulated caries/tooth loss are linked with meaningful day-to-day impacts.

Comparison with previous literature

Our results are consistent with the broader concept that OHRQoL captures patient-perceived burden beyond clinical indices, and OHIP-14 is a widely used instrument with established psychometric performance (John, 2002). The feasibility of applying OHIP-14 in Arabic-speaking settings has been demonstrated previously, including its use in periodontal populations and validation work in Arabic-speaking samples (Al Habashneh, 2012; Osman, 2018).

In diabetes-related research, earlier work suggests that periodontal status is a key driver of OHRQoL differences, while the "diabetes effect" may be less visible once periodontal status is considered (Irani, 2015). This aligns with our observation that worsening periodontal category showed a clear relationship with higher OHIP-14 scores. In addition, our finding that DMFT correlated with worse OHRQoL is similar to evidence from other chronic disease groups; for example, in chronic kidney disease, DMFT has been reported to correlate with OHRQoL domains (Tabesh, 2022). Studies in hemodialysis patients also support that OHRQoL measurement can be informative, although it may not fully capture all oral problems in high-burden medical populations (Rodakowska, 2018).

Evidence from advanced cardiac cohorts further supports that OHRQoL assessment is relevant in medically fragile populations. Cross-sectional work comparing heart failure patients with those on left ventricular assist devices reported measurable OHRQoL patterns using an OHIP short form (Schmalz, 2021), and similar work has been conducted in post–heart transplantation patients (Schmalz, 2020). Together, these studies reinforce that oral health and OHRQoL deserve attention across chronic disease pathways, not only in general dental settings.

Interpretation and clinical implications

A practical interpretation is that periodontal disease and cumulative dental disease may reduce quality of life through pain, chewing limitations, discomfort, and social impacts, which are directly reflected in OHIP-14 domains. For a tertiary hospital, this supports strengthening integrated pathways for prevention and timely dental management in chronic disease clinics. For example, patients with poor glycaemic control or high medical burden may benefit from targeted screening, early periodontal assessment, and structured referral to dental services, alongside reinforced oral hygiene support using locally appropriate education tools.

Strengths and limitations

This study has several strengths. It used a validated OHRQoL instrument with established psychometric support (John, 2002) and evidence for Arabic application (Al Habashneh, 2012; Osman, 2018). It also combined patient-reported outcomes with clinical oral measures, allowing a more complete assessment of disease burden.

However, limitations should be considered. First, the cross-sectional design does not allow causal inference; worse oral health may lead to poorer OHRQoL, but the relationship may also be influenced by

unmeasured factors (e.g., depression, diet, or healthcare access). Second, this was a single-centre study, which may limit generalisability to other settings. Third, periodontal assessment used a screening approach appropriate for clinic flow; more detailed periodontal charting could provide finer clinical differentiation. Finally, although we adjusted for key covariates, residual confounding is still possible in observational analyses.

Future directions

Future studies could (1) include multiple chronic disease groups (e.g., diabetes and CKD) and compare OHRQoL across pathways, (2) add objective dryness measures or validated xerostomia instruments where relevant, and (3) evaluate whether improving periodontal status leads to measurable improvement in OHRQoL using longitudinal designs. Work in peritoneal dialysis populations suggests oral health measures can even relate to clinical outcomes, supporting the value of extending research beyond patient-reported endpoints alone (Purisinsith, 2022).

CONCLUSION

Among adults with type 2 diabetes attending a tertiary hospital in Saudi Arabia, worse periodontal status and higher DMFT were associated with poorer OHRQoL. These findings support incorporating structured oral health assessment and prevention within chronic disease care pathways and prioritising periodontal management as part of patient-centred care.

REFERENCES:

1. Al Habashneh, R., Khader, Y.S. & Salameh, S. (2012). Use of the Arabic version of Oral Health Impact Profile-14 to evaluate the impact of periodontal disease on oral health-related quality of life among Jordanian adults. *Journal of Oral Science*, 54(1), 113–120. https://doi.org/10.2334/josnusd.54.113 (PubMed)
2. de Pinho, A.M.D., Borges, C.M.P., et al. (2012). Impact of periodontal disease on the quality of life of diabetics based on different clinical diagnostic criteria. *International Journal of Dentistry*, 2012, 986412. https://doi.org/10.1155/2012/986412 (PMC)
3. Garbade, J., Rast, J., Schmalz, G., et al. (2020). Oral health and dental behaviour of patients with left ventricular assist device: a cross-sectional study. *ESC Heart Failure*, 7(3), 1273–1281. https://doi.org/10.1002/ehf2.12636 (PubMed)
4. Irani, F.C., Wassall, R.R. & Preshaw, P.M. (2015). Impact of periodontal status on oral health-related quality of life in patients with and without type 2 diabetes. *Journal of Dentistry*, 43(5), 506–511. https://doi.org/10.1016/j.jdent.2015.03.001 (PubMed)
5. John, M.T., Patrick, D.L. & Slade, G.D. (2002). The German version of the Oral Health Impact Profile—translation and psychometric properties. *European Journal of Oral Sciences*, 110(6), 425–433. https://doi.org/10.1034/j.1600-0722.2002.21363.x (PubMed)
6. Osman, S.M., Khalifa, N. & Alhajj, M.N. (2018). Validation and comparison of the Arabic versions of GOHAI and OHIP-14 in patients with and without denture experience. *BMC Oral Health*, 18(1), 157. https://doi.org/10.1186/s12903-018-0620-5 (PubMed)
7. Purisinsith, S., et al. (2022). Oral health-related quality of life and treatment adherence in patients receiving peritoneal dialysis. *Kidney International Reports*. PMID: 36217510. (PubMed)
8. Rodakowska, E., Wilczyńska-Borawska, M., Fryc, J., Baginska, J. & Naumnik, B. (2018). Oral health-related quality of life in patients undergoing chronic hemodialysis. *Patient Preference and Adherence*, 12, 955–961. https://doi.org/10.2147/PPA.S161638 (PubMed)
9. Schmalz, G., Eisner, M., Binner, C., et al. (2021). Oral health-related quality of life in patients with heart failure and left ventricular assist devices: a cross-sectional study. *Clinical Oral Investigations*. PMID: 33754192. (PubMed)

10. Schmalz, G., Eisner, M., Binner, C., et al. (2020). Oral health-related quality of life of patients after heart transplantation and those with heart failure is associated with general health-related quality of life: a cross-sectional study. *Quality of Life Research*, 29(6), 1621–1630. https://doi.org/10.1007/s11136-020-02439-z (PubMed)
11. Tabesh, A., Abtahi, M.S., Narimany, R. & Abtahi, M.S. (2022). Oral health-related quality of life in chronic kidney disease patients. *Dental Research Journal (Isfahan)*, 19, 73. (PubMed)