Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Prosthetic status, tooth loss and oral health-related quality of life in oral lichen planus: an exploratory observational study

Michael Edelmayer

michael.edelmayer@meduniwien.ac.at

Medical University of Vienna, University Clinic of Dentistry

Lana Zupancic-Cepic

Medical University of Vienna, University Clinic of Dentistry

Simone Heuberer

Medical University of Vienna, University Clinic of Dentistry

Gabriella Dvorak

Medical University of Vienna, University Clinic of Dentistry

Research Article

Keywords: Oral lichen planus, Quality of life, Tooth loss, Dental prosthesis, Removable partial denture, Fixed partial denture, Patient-reported outcome measures, Oral Health Impact Profile

Posted Date: September 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10935762/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Oral lichen planus (OLP) can impair oral health-related quality of life (OHRQoL). Mechanical irritation by removable prostheses has been proposed as an aggravating factor, but comparative evidence is scarce and tooth loss differs between prosthetic groups.

Methods

This exploratory observational study used 138 assessments from 92 adults with clinically and histopathologically confirmed OLP; primary inference used each participant's earliest assessment. OHRQoL was measured with the German 53-item Oral Health Impact Profile (OHIP-G). Three OHIP items refer explicitly to dentures and were answered almost exclusively by appliance wearers, so the primary outcome was the sum of the remaining 50 items (OHIP-G-50), the full score serving as a sensitivity analysis. The primary model used HC3 robust standard errors and adjusted for sex, age, smoking, missing teeth and prosthetic status; the Clinical Severity Index (CSI), a possible intermediate, entered a secondary model. Multiple imputation, restriction to the shared tooth-loss range and patient-balanced repeated-assessment analysis were sensitivity analyses.

Results

Baseline median OHIP-G-50 scores were 59.5 with removable prostheses, 38.0 with fixed prosthodontics and 44.0 without a prosthesis ($P = 0.233$). In the primary model (n = 74), adjusted differences versus fixed prosthodontics were 15.5 points for removable prostheses (95% CI − 10.8 to 41.8) and 8.2 points for no prosthesis (95% CI − 16.2 to 32.7); the direct removable-versus-no-prosthesis contrast was 7.3 points (95% CI − 17.8 to 32.4). Multiple imputation gave a similar estimate (15.6 points). Within the shared range of 1–18 missing teeth the estimates versus fixed prosthodontics were 24.0 and 27.1 points, their direct contrast − 3.1 points. The three denture-specific items contributed a mean of 3.9 points to the removable group alone, accounting for 3.7 points of the corresponding 53-item estimate. CSI was strongly associated with poorer OHRQoL (13.2 points per unit; $P = 0.001$).

Conclusions

Adjusted differences were imprecise and did not identify an OHRQoL disadvantage specific to removable prostheses. Similar estimates for removable prostheses and no prosthesis within comparable tooth loss argue against an appliance-specific explanation and are compatible with favorable selection into fixed prosthodontics. Part of the crude between-group difference reflects denture-specific OHIP items rather than disease burden. These findings are hypothesis-generating.

Background

Oral lichen planus (OLP) is a chronic, immune-mediated inflammatory disease of the oral mucosa with a pooled global prevalence of approximately 1% [1, 2]. It affects middle-aged and older adults, predominantly women, and typically follows a relapsing and remitting course. OLP is also classified among the oral potentially malignant disorders, which is the rationale for long-term clinical surveillance [3, 4].

The clinical expression of OLP ranges from asymptomatic reticular white striae to erythematous, atrophic, erosive and ulcerative lesions that may cause pain, burning and impaired eating. Systematic review evidence confirms a clinically meaningful burden on oral health-related quality of life (OHRQoL) [5], while recent work emphasizes that patient-reported impact is only partly captured by clinician-rated severity [6, 7]. Pain, psychological distress and disease activity are among the most consistent correlates of impaired OHRQoL in this population [6, 8].

Local trauma and dental plaque may exacerbate oral mucosal lesions. Reduction of mechanical irritants, meticulous plaque control and correction of poorly fitting prostheses are therefore established components of non-pharmacological management [9, 10]. The Koebner, or isomorphic, response provides a biologically plausible mechanism for lesion aggravation at sites of chronic friction, and an early clinical report recommended minimizing the mucosal loading caused by removable prostheses in selected patients [11, 12]. Nevertheless, the type of restorative material alone does not appear to explain OHRQoL impairment in OLP, and contemporary comparative evidence on prosthetic design in this population remains sparse [13].

In broader prosthodontic populations, tooth loss and prosthetic rehabilitation strongly influence oral function and OHRQoL. Both fixed and removable implant-supported treatments can produce substantial improvements in patient-reported outcomes, and differences between modalities depend on stability, maintenance burden, anatomy and patient preference [14, 15]. In patients with stabilized OLP, current meta-analytic evidence does not indicate compromised implant survival, although treatment during acute disease activity and direct causal claims remain inappropriate [16].

The primary objective of this exploratory study was to examine whether prosthetic status was associated with OHRQoL at the patient-level baseline assessment. Pain and clinical OLP severity were evaluated as secondary descriptors and correlates. We hypothesized that participants with removable prostheses would have higher OHIP-G scores than those with tooth-replacing fixed prosthodontics after accounting for patient characteristics and the extent of tooth loss.

Methods

Study design, setting and ethics

This exploratory observational study analyzed prospectively collected clinical data from the oral mucosal disease service of the University Clinic of Dentistry, Medical University of Vienna, and from the Department of Dermatology, Klinik Landstrasse, Vienna, Austria. Assessments recorded between September 2011 and June 2014 were available for analysis.

The study was conducted in accordance with the Declaration of Helsinki. Data were collected in the course of routine clinical care, and the analysis of these prospectively collected data was approved by the Ethics Committee of the Medical University of Vienna (EK No. 1198/2013). All participants received detailed information about the study and gave written informed consent before inclusion.

Data structure and definition of the baseline visit

The analyzable dataset contained 138 clinical assessments belonging to 92 individuals because a proportion of participants attended more than one visit during the recruitment period. Records were linked at patient level before analysis. For each individual, the earliest dated assessment was defined as the baseline visit; where a visit date was unavailable, the first recorded assessment was used. Primary inference was deliberately restricted to this single patient-level baseline assessment so that participants with more clinical visits did not contribute disproportionate weight. Repeated assessments were retained only for secondary sensitivity analyses.

Participants and diagnostic assessment

Adults aged 18 years or older who presented at, or were referred to, the oral mucosal disease clinic for assessment or treatment of an oral mucosal lesion were eligible. OLP was diagnosed on the basis of compatible clinical findings and confirmed histopathologically by incisional biopsy, as documented in the clinical records. Direct immunofluorescence was performed at the Department of Dermatology, Klinik Landstrasse, to exclude autoimmune bullous disease and other lichenoid conditions. Lesion size, site and clinical appearance were documented, and the diagnosis was established independently by two specialists in oral mucosal disease. The study used a consecutive convenience sample of the clinic population; no a priori sample-size calculation was performed.

Clinical severity and pain

OLP severity was graded independently by the two examiners with the six-point Thongprasom Clinical Severity Index (CSI): 0, no lesion; 1, mild white striae without erythema; 2, white striae with atrophic areas smaller than 1 cm^2; 3, white striae with atrophic areas larger than 1 cm^2; 4, white lesions with ulceration smaller than 1 cm^2; and 5, white lesions with ulceration larger than 1 cm^2 [17]. The mean of the two ratings was used in all association analyses, and inter-examiner agreement was quantified with Cohen's kappa. Clinical subtype was derived from the CSI grade (reticular, CSI 1; atrophic, CSI 2–3; erosive, CSI

4–5) rather than recorded as a separate variable, and subtype and severity therefore represent the same underlying measurement.

Pain was recorded by the participants on a 100-mm horizontal visual analog scale (VAS) anchored by "no pain" and "worst pain imaginable," and was expressed on a 0–10 scale.

Oral health-related quality of life

OHRQoL was measured with the German 53-item version of the Oral Health Impact Profile (OHIP-G) [18], which comprises the 49 items of the original instrument (OHIP-49) together with four items developed for the German version: taking longer to complete a meal, avoiding eating with others, embarrassing jaw-joint or ear noises, and dry mouth. Items refer to the preceding month and are scored from 0 (never) to 4 (very often), giving a total score between 0 and 212; higher scores indicate poorer OHRQoL [19].

Three items of the OHIP-49 refer explicitly to dentures (ill-fitting dentures, uncomfortable dentures and inability to wear dentures) and are not applicable to participants without a removable appliance. In the present cohort they were completed by 31 of 32 participants with removable prostheses, by none of the 23 participants with fixed prosthodontics and by 1 of 37 participants without a prosthesis, and unanswered items entered the total as zero. Their completion was therefore almost perfectly collinear with the exposure of interest, and any total score containing them is not directly comparable between appliance wearers and other participants. The primary outcome was accordingly defined as the sum of the remaining 50 items (OHIP-G-50, range 0–200), and the full 53-item score (OHIP-G-53, range 0–212) is reported as a sensitivity analysis throughout.

Domain scores were calculated for the seven original dimensions (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap) and for the four German-version items. The three domains that contain a denture-specific item – functional limitation, physical pain and physical disability – were recalculated without it, giving a range of 0–32 instead of 0–36 for each. The scores of the four-dimensional framework (oral function, orofacial pain, psychosocial impact and appearance), which is based on a subset of OHIP items identified by factor analysis, were derived in addition [20, 21]. Because the item composition of these four scores was not recorded in the analysis dataset, their observed rather than their possible ranges are reported.

Prosthetic status

Prosthetic status was assessed clinically at every visit and recorded as a single variable with three mutually exclusive categories: removable prosthesis (partial or complete dentures, including mucosa-borne and tooth-mucosa-borne designs), fixed prosthodontics, or no prosthesis. The fixed category was restricted to tooth-replacing restorations, including conventional and cantilever fixed dental prostheses and fixed implant-supported restorations. Isolated single crowns were not included unless they served

as abutments for a tooth-replacing fixed prosthesis. The number of missing teeth and the presence of dental implants were recorded separately.

Statistical analysis

Continuous variables are reported as median (first to third quartile, Q1–Q3) or as mean (standard deviation [SD]), as appropriate; categorical variables are reported as counts and percentages. Baseline comparisons between prosthetic groups used the Kruskal-Wallis test for continuous outcomes and the chi-square test for categorical variables; pairwise Mann-Whitney tests adjusted for multiplicity with the Holm procedure were planned only where the omnibus test reached significance. Associations between continuous variables were described with Spearman rank correlation coefficients (r_s). Inter-examiner agreement for the CSI was assessed with unweighted Cohen's kappa, with quadratic-weighted kappa reported as a sensitivity estimate.

The OHIP-G-50 total score, the OHIP-G-53 total score and the four-dimensional summary score were near-collinear ($r_s \geq 0.95$). Only the OHIP-G-50 total score was therefore carried forward as the outcome of multivariable analyses, with OHIP-G-53 repeated in parallel as a sensitivity analysis. VAS pain was not entered as a covariate because mucosal discomfort may lie on the pathway between prosthesis-related irritation and impaired OHRQoL. For the same reason, concurrently measured CSI was not included in the primary model; instead, a separate secondary model added CSI to quantify how the prosthetic-status estimates changed after adjustment for clinical disease severity.

The primary multivariable analysis was an ordinary least-squares regression of the baseline OHIP-G-50 total score with heteroskedasticity-consistent HC3 standard errors [22]. Covariates were chosen a priori on clinical grounds and comprised sex, age, smoking status, number of missing teeth and prosthetic status, with fixed prosthodontics as the reference category. Complete baseline cases were analyzed. In addition to the two contrasts versus fixed prosthodontics, the removable-versus-no-prosthesis contrast was estimated directly from the fitted model. The secondary severity-adjusted model added CSI while otherwise retaining the same specification.

Missing baseline data were characterized by variable and prosthetic group. One record carried the participant's date of birth in the visit-date field and consequently an age of zero; the age was recovered from the recorded date of birth and the record retained. As a sensitivity analysis, missing age, smoking status and number of missing teeth were multiply imputed in 50 datasets using chained stochastic regression models that included OHIP-G-50, sex, age, smoking status, number of missing teeth, prosthetic status, CSI and implant status; pooled estimates were obtained using Rubin's rules [23]. To reduce extrapolation across markedly different tooth-loss distributions, the complete-case baseline model was also refitted after restriction to the shared observed range of 1–18 missing teeth. Finally, repeated assessments were analyzed in a patient-balanced sensitivity model in which each participant's eligible observations were weighted to sum to one and robust standard errors were clustered by patient. This model was intended as a check on direction and magnitude rather than as a within-patient effect estimate, because prosthetic status changed in only four individuals.

Two-sided *P* values below 0.05 were considered statistically significant. Given the exploratory design, interpretation emphasized effect estimates and 95% confidence intervals (CIs) rather than dichotomous significance testing. The domain-level comparisons are exploratory, are reported without adjustment for multiplicity, and are not intended to support confirmatory claims. Analyses were performed in Python 3.11 using pandas 3.0, statsmodels 0.15 and SciPy 1.17; the analysis script is available with the data (see Availability of data and materials). Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations [24]; the completed checklist is provided as Additional file 1.

Results

Participants and assessments

All 138 recorded assessments, contributed by 92 individuals, were eligible; no participant was excluded on clinical grounds. The flow of assessments and participants through the analysis is shown in Fig. 1. Sixty-one individuals contributed a single assessment and 31 contributed between two and six assessments. At the patient-level baseline visit, 65 participants (70.7%) were women and 27 (29.3%) were men, and the mean age was 58.4 years (SD 13.0; n = 90; age unavailable in two participants). Thirty-two participants had a removable prosthesis, 23 had fixed prosthodontics and 37 had no prosthesis. Baseline characteristics by prosthetic group are shown in Table 1. Participants without a prosthesis were markedly younger and had fewer missing teeth than those in the two prosthetically rehabilitated groups, and dental implants were most frequent in the fixed group. Smoking status was unavailable in 16 participants and was distributed similarly across groups.

Table 1
Baseline participant characteristics by prosthetic status

Characteristic	Removable (n = 32)	No prosthesis (n = 37)	Fixed (n = 23)	P
Women, n (%)	23 (71.9)	23 (62.2)	19 (82.6)	0.235
Age, years	65.1 (55.7–72.6)	52.2 (46.8–58.3)	62.8 (55.2–69.2)	< 0.001
Missing teeth, n	10.0 (6.0–19.8)	0.0 (0.0–3.0)	4.0 (2.0–9.0)	< 0.001
Dental implant present, n (%)	3 (9.4)	4 (10.8)	10 (43.5)	0.002
Never smoker, n (%)[a]	18 (62.1)	21 (75.0)	10 (52.6)	0.364
Current smoker, n (%)[a]	6 (20.7)	6 (21.4)	5 (26.3)	
Former smoker, n (%)[a]	5 (17.2)	1 (3.6)	4 (21.1)	
Smoking status missing, n	3	9	4	
CSI	2.2 (1.0–4.0)	2.0 (1.0–3.0)	3.0 (1.0–3.5)	0.668
VAS pain (0–10)	2.0 (0.0–5.0)	2.5 (0.0–4.1)	1.1 (0.0–3.8)	0.887
OHIP-G-50 total	59.5 (31.5–82.2)	44.0 (21.0–62.0)	38.0 (15.0–67.0)	0.233
OHIP-G-53 total	65.0 (33.8–86.5)	44.0 (21.0–63.0)	38.0 (15.0–67.0)	0.069

Values are median (first to third quartile) unless otherwise stated. P values are derived from Kruskal-Wallis tests for continuous variables and chi-square tests for categorical variables. [a]Percentages refer to participants with a recorded smoking status. CSI Clinical Severity Index, OHIP-G-50 German 53-item Oral Health Impact Profile excluding the three denture-specific items, OHIP-G-53 full German 53-item Oral Health Impact Profile, VAS visual analog scale

At baseline, the reticular, atrophic and erosive clinical subtypes – derived from the CSI grade – were recorded in 30 (32.6%), 36 (39.1%) and 26 (28.3%) participants, respectively, and the median CSI was 2.0 (Q1–Q3 1.0–3.5). Inter-examiner agreement was substantial on the unweighted scale (kappa = 0.797; n = 135 assessments) and high with quadratic weighting (kappa = 0.942).

Denture-specific items and the definition of the outcome

The three denture-specific OHIP items were completed by 31 of 32 participants with removable prostheses, by 1 of 37 participants without a prosthesis and by none of the 23 participants with fixed prosthodontics (chi-square $P < 0.001$). They contributed a mean of 3.9 points (median 3, maximum 12)

to the OHIP-G-53 total in the removable group, 0.2 points in the group without a prosthesis and 0 points in the fixed group. All results below therefore refer to the OHIP-G-50 score; the corresponding 53-item results are given alongside and in Additional file 2.

Baseline oral health-related quality of life, pain and prosthetic status

The overall baseline median OHIP-G-50 score was 51.5 (Q1–Q3 18.8–65.0). Median scores were 59.5 (Q1–Q3 31.5–82.2) in the removable group, 38.0 (Q1–Q3 15.0–67.0) in the fixed group and 44.0 (Q1–Q3 21.0–62.0) in participants without a prosthesis (Fig. 2). The omnibus difference did not reach the conventional significance threshold ($P = 0.233$), and no pairwise comparisons were therefore performed. With the full 53-item score the corresponding medians were 65.0, 38.0 and 44.0 ($P = 0.069$).

In the 53-item analysis, functional limitation, physical pain and physical disability were – apart from the German-version items – the domains with the lowest *P* values (0.087 to 0.147). These are the three domains that contain a denture-specific item, and after its removal each rose to between 0.283 and 0.394, so that none of them remained distinguishable from the domains that never contained one (Table 2; both versions in Additional file 2). The four German-version items were the only domain that differed between groups at baseline (median 4.0, 2.0 and 2.0 in the removable, no-prosthesis and fixed groups; $P = 0.020$), a comparison that is exploratory and unadjusted for multiplicity.

Table 2
Baseline OHIP-G domain and four-dimensional scores by prosthetic status

Score (range)	Removable	No prosthesis	Fixed	P
OHIP-G-50 total (0–200)	59.5 (31.5–82.2)	44.0 (21.0–62.0)	38.0 (15.0–67.0)	0.233
Functional limitation (0–32)[b]	10.5 (4.0–15.5)	8.0 (5.0–11.0)	7.0 (2.0–10.0)	0.283
Physical pain (0–32)[b]	12.0 (8.0–21.0)	10.0 (5.0–19.0)	10.0 (5.0–16.0)	0.394
Psychological discomfort (0–20)	9.0 (3.5–12.2)	7.0 (3.0–9.0)	6.0 (1.5–11.5)	0.330
Physical disability (0–32)[b]	7.0 (2.0–10.5)	5.0 (1.0–9.0)	4.0 (0.0–10.0)	0.291
Psychological disability (0–24)	7.0 (2.0–12.0)	5.0 (1.0–8.0)	4.0 (1.0–9.5)	0.254
Social disability (0–20)	2.0 (0.8–4.0)	2.0 (0.0–4.0)	3.0 (0.0–3.5)	0.807
Handicap (0–24)	4.5 (1.8–7.0)	3.0 (1.0–7.0)	3.0 (0.0–6.0)	0.521
German-version items (0–16)	4.0 (1.8–6.0)	2.0 (0.0–4.0)	2.0 (0.0–3.0)	0.020
Oral function (0–12)[c]	3.0 (1.0–4.2)	2.0 (1.0–4.0)	0.0 (0.0–4.0)	0.099
Orofacial pain (0–24)[c]	10.0 (7.0–17.0)	8.0 (4.0–15.0)	9.0 (5.0–13.0)	0.581
Psychosocial impact (0–30)[c]	8.0 (1.8–11.0)	4.0 (0.0–8.0)	3.0 (0.0–9.0)	0.374
Appearance (0–12)[c]	4.0 (2.0–7.2)	4.0 (2.0–6.0)	3.0 (1.0–6.0)	0.625

Values are median (first to third quartile). Higher scores indicate poorer oral health-related quality of life. Rows 2–8 are the seven original OHIP domains, row 9 the four items specific to the German version, and rows 10–13 the four-dimensional framework scores. Ranges given for the total score, the domains and the German-version items are possible ranges; for the four-dimensional scores the ranges observed in this sample are given, because the item composition of these scores was not recorded in the analysis dataset. P values are derived from Kruskal-Wallis tests and are not adjusted for multiplicity. [b]Domain recalculated without its denture-specific item, giving a possible range of 0–32 instead of 0–36. [c]Four-dimensional framework according to John et al. [20, 21]; observed range. OHIP-G-50 German 53-item Oral Health Impact Profile excluding the three denture-specific items

Baseline pain did not differ by prosthetic status ($P = 0.887$), nor did clinical severity ($P = 0.668$). VAS pain correlated moderately with CSI ($r_s = 0.45$; $P < 0.001$) and strongly with the OHIP-G-50 total score ($r_s = 0.72$; $P < 0.001$), and CSI correlated moderately with OHIP-G-50 ($r_s = 0.46$; $P < 0.001$) (Table 3).

Table 3
Spearman correlations between key outcomes at the baseline visit

Correlation	n	r_s	P
VAS pain – CSI	85	0.45	< 0.001
VAS pain – OHIP-G-50	85	0.72	< 0.001
CSI – OHIP-G-50	92	0.46	< 0.001
OHIP-G-50 – OHIP-G-53	92	0.99	< 0.001
OHIP-G-50 – four-dimensional score	91	0.95	< 0.001

Spearman rank correlation coefficients at the baseline visit. CSI Clinical Severity Index, OHIP-G-50 German 53-item Oral Health Impact Profile excluding the three denture-specific items, OHIP-G-53 full German 53-item Oral Health Impact Profile, r_s Spearman rank correlation coefficient, VAS visual analog scale

Primary multivariable and sensitivity analyses

Across all 138 assessments, the unadjusted median OHIP-G-50 score was 60.0 with a removable prosthesis, 37.0 with fixed prosthodontics and 43.5 without a prosthesis (Kruskal-Wallis $P = 0.045$; with the 53-item score, 65.0, 37.0 and 43.5, $P = 0.010$). Because visit frequency was clinically driven and some individuals contributed multiple assessments, this assessment-level comparison is reported descriptively only and was not used for primary inference.

The primary patient-level complete-case model included 74 of the 92 baseline participants (Table 4). Compared with fixed prosthodontics, the adjusted difference in OHIP-G-50 was 15.5 points for removable prostheses (95% CI − 10.8 to 41.8; $P = 0.247$) and 8.2 points for no prosthesis (95% CI − 16.2 to 32.7; $P = 0.509$). The direct removable-versus-no-prosthesis contrast was 7.3 points (95% CI − 17.8 to 32.4; $P = 0.569$). With the 53-item score the removable-versus-fixed estimate was 19.2 points (95% CI − 7.3 to 45.6; $P = 0.156$), that is, 3.7 points higher than the estimate based on the 50 non-denture items. Thus, the baseline data did not provide evidence that the removable group differed specifically from participants without a prosthesis.

Table 4
Baseline linear regression of the OHIP-G-50 total score

Predictor	Primary b (95% CI)	P	Severity-adjusted b (95% CI)	P
Women vs men	18.8 (− 0.1 to 37.8)	0.052	18.0 (2.3 to 33.7)	0.025
Age, per year	0.0 (− 0.8 to 0.8)	0.959	−0.2 (− 0.9 to 0.6)	0.631
Current vs never smoker	3.8 (− 19.9 to 27.5)	0.755	9.4 (− 12.1 to 30.8)	0.393
Former vs never smoker	8.7 (− 30.0 to 47.5)	0.659	10.9 (− 22.0 to 43.8)	0.516
Missing teeth, per tooth	0.6 (− 0.8 to 2.1)	0.388	0.6 (− 1.1 to 2.3)	0.470
Removable vs fixed prosthodontics	15.5 (− 10.8 to 41.8)	0.247	19.0 (− 8.0 to 46.0)	0.167
No prosthesis vs fixed prosthodontics	8.2 (− 16.2 to 32.7)	0.509	13.9 (− 6.8 to 34.6)	0.187
CSI, per point	–	–	13.2 (5.3 to 21.2)	0.001
Removable vs no prosthesis	7.3 (− 17.8 to 32.4)	0.569	5.1 (− 19.9 to 30.1)	0.690

Ordinary least-squares regression of the baseline OHIP-G-50 total score with HC3 robust standard errors; complete-case models based on 74 individuals. The primary model adjusts for sex, age, smoking status, number of missing teeth and prosthetic status. The secondary severity-adjusted model adds CSI. Fixed prosthodontics, men and never-smokers are reference categories. b denotes the adjusted difference in OHIP-G-50 points; positive values indicate poorer oral health-related quality of life. The corresponding analysis using the full 53-item score is provided as Additional file 2. CI confidence interval, CSI Clinical Severity Index, OHIP-G-50 German 53-item Oral Health Impact Profile excluding the three denture-specific items

In the secondary model that additionally adjusted for CSI, the removable-versus-fixed estimate was 19.0 points (95% CI − 8.0 to 46.0; *P* = 0.167), the no-prosthesis-versus-fixed estimate was 13.9 points (95% CI − 6.8 to 34.6; *P* = 0.187), and the direct removable-versus-no-prosthesis contrast remained small (5.1 points; 95% CI − 19.9 to 30.1; *P* = 0.690). Each one-point increase in CSI was associated with a 13.2-point higher OHIP-G-50 score (95% CI 5.3 to 21.2; *P* = 0.001), and women had an 18.0-point higher adjusted score than men (95% CI 2.3 to 33.7; *P* = 0.025).

At baseline, age was missing in 2 participants, smoking status in 16 and the number of missing teeth in 7, with overlap between variables. Eighteen participants were therefore excluded from the complete-case primary model. Their median OHIP-G-50 score did not differ materially from that of included participants (42.5 versus 54.5; Mann-Whitney *P* = 0.446), and the distribution of prosthetic groups did not differ

significantly between included and excluded participants (chi-square $P = 0.302$). Multiple imputation of the missing covariates retained all 92 participants and yielded closely similar estimates: 15.6 points for removable versus fixed prosthodontics (95% CI − 8.6 to 39.7; $P = 0.207$) and 10.8 points for no prosthesis versus fixed (95% CI − 9.4 to 31.0; $P = 0.296$).

Restriction to the shared observed range of 1–18 missing teeth left 48 complete-case baseline participants: 20 with removable prostheses, 11 without a prosthesis and 17 with fixed prosthodontics. In this restricted sample, the adjusted estimates versus fixed prosthodontics were 24.0 points for removable prostheses (95% CI − 5.7 to 53.7; $P = 0.113$) and 27.1 points for no prosthesis (95% CI − 5.7 to 59.9; $P = 0.105$). The direct removable-versus-no-prosthesis contrast was − 3.1 points (95% CI − 35.5 to 29.3; $P = 0.852$).

The patient-balanced repeated-assessment sensitivity analysis included 111 eligible assessments from 76 participants; each participant's observations were weighted to contribute equally overall. The estimate for removable versus fixed prosthodontics was 18.3 points (95% CI − 5.0 to 41.7; $P = 0.124$), and that for no prosthesis versus fixed was 10.3 points (95% CI − 11.0 to 31.6; $P = 0.344$). The removable-versus-no-prosthesis contrast was 8.0 points (95% CI − 15.0 to 31.0; $P = 0.494$). Adjusted differences across all model specifications, for both the 50-item and the 53-item outcome, are summarized in Fig. 3. These estimates were directionally consistent with the baseline analysis but remained imprecise, and the 53-item estimates were systematically larger than the 50-item estimates in every specification.

Prosthetic status changed between visits in only four of the 92 individuals. The repeated data therefore added little information for estimating a within-patient prosthetic effect and were retained only as a secondary robustness check. The primary interpretation is based on the one-assessment-per-patient baseline analysis.

Discussion

In this exploratory study, the removable-prosthesis group had the highest unadjusted OHIP-G score at baseline, but the patient-level adjusted estimates were imprecise. In the primary model, the adjusted difference versus fixed prosthodontics was 15.5 points for removable prostheses and 8.2 points for no prosthesis, while the direct removable-versus-no-prosthesis contrast was only 7.3 points and its confidence interval was wide. Adding CSI, multiply imputing missing covariates and using patient-balanced repeated assessments did not materially alter this pattern. Most importantly, within the shared observed range of tooth loss, the removable and no-prosthesis groups had very similar adjusted point estimates relative to fixed prosthodontics, and their direct contrast was close to zero. The data therefore do not demonstrate an OHRQoL disadvantage specific to wearing a removable appliance.

A structural feature of the OHIP-49 deserves emphasis. Three of its items ask specifically about dentures and are answered only by appliance wearers, so any total score that includes them is not comparable between denture wearers and other groups. That item applicability varies with the

population under study is well recognized: a range of condition-specific OHIP versions exists, including forms developed for edentulous patients [25]. What appears not to have been addressed is the consequence for comparisons between prosthetic groups scored with the full-length instrument. In the present data these items contributed a mean of 3.9 points to the removable group and essentially nothing to the other two, and they accounted for 3.7 of the 19.2 points by which the removable group exceeded the fixed group in the 53-item model – close to one fifth of that estimate. The same mechanism explains why functional limitation, physical pain and physical disability – the three domains that contain a denture item – had the lowest *P* values of the seven original domains in the 53-item analysis, and why that ranking disappeared once the item was removed. Studies comparing prosthetic modalities with OHIP totals should either exclude these items or report both versions; not doing so inflates the apparent burden of removable prostheses by construction.

One domain did separate the removable group from both other groups after this correction: the four items specific to the German version (median 4.0 versus 2.0 and 2.0; $P = 0.020$). These ask about taking longer to complete a meal, avoiding eating with others, embarrassing jaw-joint or ear noises, and dry mouth. None of them is restricted to appliance wearers, so the difference is not a scoring artifact. It is the only signal in these data that is specific to the removable group rather than shared with participants who had no prosthesis, and it concerns eating and oral comfort rather than mucosal disease. Whether it reflects the appliance itself – palatal coverage, altered chewing, or reluctance to eat in company – or the greater tooth loss of that group cannot be resolved here. The comparison is one of twelve reported in Table 2, is unadjusted for multiplicity and is hypothesis-generating; it qualifies rather than contradicts the absence of a difference in the total score.

The comparison is also structurally confounded by indication and oral status. At baseline, the median number of missing teeth was 10 in the removable group, 4 in the fixed group and 0 in participants without a prosthesis, while dental implants were substantially more frequent in the fixed group. Participants without a prosthesis were also younger. The primary patient-level analysis avoids giving additional weight to patients who returned more often, but statistical adjustment for a single tooth-count term cannot fully remove the clinical and socioeconomic selection processes that determine prosthetic treatment. The fixed-prosthodontic group may therefore represent a more favorably selected population with better preserved function, greater treatment resources or better access to care rather than a biological advantage of the prosthesis itself.

The analysis restricted to the shared observed range of 1–18 missing teeth is informative because it reduces, but does not eliminate, this extrapolation. Both the removable and no-prosthesis groups showed adjusted OHIP-G-50 point estimates around 24–27 points higher than the fixed group, while the direct difference between removable and no prosthesis was − 3.1 points with a very wide confidence interval. If mechanical irritation by the removable appliance were the dominant mechanism, a clearer separation between the removable and no-appliance groups would be expected. Instead, these data are more compatible with favorable selection into fixed rehabilitation or with broader consequences of tooth

loss and incomplete rehabilitation. The restricted sample was small, especially the no-prosthesis group, so this interpretation remains hypothesis-generating.

Functional and nutritional consequences of tooth loss provide one plausible alternative pathway that may contribute to the observed OHRQoL pattern. Tooth loss is associated with measurably poorer nutritional status: a meta-analysis of six studies found that adults who were edentulous or lacked functional dentition were about a fifth more likely to be malnourished or at risk of malnutrition than those with functionally adequate dentition (risk ratio 1.21; 95% CI 1.11 to 1.32), although heterogeneity was considerable [26]. A second meta-analysis reported that compromised oral processing, encompassing denture status, chewing ability and the number of teeth, was associated with a daily intake lower by approximately 107 kcal and 5.2 g of protein [27], and analyses of the third National Health and Nutrition Examination Survey (NHANES III) found that denture wearers consumed carrots and tossed salads substantially less often than the fully dentate, with correspondingly lower serum beta-carotene, folate and vitamin C [28]. This evidence is not uniform: a further meta-analysis identified the number of teeth and functional tooth units, but not edentulism as such, as associated with nutritional status [29]. Taken together, this literature is consistent with our interpretation that the burden attaches to inadequately restored function rather than to the removable appliance itself, and it suggests that nutritional screening deserves a place alongside OHRQoL assessment in patients with OLP who have substantial tooth loss.

Two recent NHANES analyses sharpen this point. Using a modified treatment policies framework with targeted maximum likelihood estimation, Tay and colleagues estimated that if all participants aged 60 years and over retained at least 25 teeth, the odds of achieving a better Healthy Eating Index score would be 51% higher (odds ratio 1.51; 95% CI 1.32 to 1.69), and that preserving the natural dentition improved diet quality considerably more than prosthetic rehabilitation alone [30]. In a companion analysis with mortality as the endpoint, the excess risk relative to participants with at least five posterior occluding units of natural teeth was greatest in those with fewer than five units and no posterior prosthetic rehabilitation (adjusted hazard ratio 1.60; 95% CI 1.22 to 2.09), intermediate for units restored with removable or tooth-supported fixed prostheses (1.27; 95% CI 1.10 to 1.48), and absent for implant-supported units (1.00; 95% CI 0.77 to 1.30) [31]. A further analysis from the same group identifies diet quality as a partial mediator of the association between tooth loss and cardiovascular disease [32]. That gradient is defined by how completely function is restored rather than by the presence of an appliance, which is the same distinction our data point to: within comparable tooth loss, participants with a removable prosthesis and those with none differed hardly at all, while the fixed group fared best. It is not a full parallel – in our crude and primary estimates the removable group, not the unrehabilitated group, had the poorest scores – and these are observational analyses of the general older population rather than of patients with OLP, so they cannot be read as an indication for implant therapy in this disease.

For context, differences of the magnitude estimated here would not be trivial if they were confirmed. In patients with OLP, the reported threshold for a meaningful change in OHIP-based measures corresponds to a small number of summary points [33], so an adjusted difference of 15 to 24 points would be clinically relevant. The imprecision of the estimates, rather than their size, is the limiting factor here: the

confidence interval around the primary removable-versus-fixed estimate spans 53 points, so the data exclude only differences smaller than − 11 or larger than + 42 points and are compatible both with no difference and with one of clear clinical importance.

The findings are consistent with evidence that OLP has a moderate adverse effect on OHRQoL and that pain and clinical activity are among its major determinants [5, 6, 8, 33]. In the present data, VAS pain was strongly and CSI moderately associated with the OHIP-G-50 total score. Recent work likewise demonstrates only partial correspondence between clinician-rated disease severity and patient-reported impact, which reinforces the need to collect both types of outcome [7]. Psychological factors may further modify OHRQoL in OLP and were not captured comprehensively in the present dataset [34].

A prosthesis-specific association is clinically plausible. Removable appliances generate friction and pressure on the mucosa and create plaque-retentive areas, whereas fixed designs generally reduce the area of mucosal coverage. However, Koebner-type irritation was not measured directly, and information on prosthesis fit, retention, occlusion, hygiene and mucosal contact area was unavailable. The present data therefore cannot distinguish a mechanical effect from confounding by indication, extent of tooth loss, age, access to care or unmeasured systemic and psychosocial factors. A contemporary study of restorative materials in OLP similarly identified pain, rather than material category, as the dominant correlate of OHRQoL [13].

The broader prosthodontic literature also cautions against a simple fixed-versus-removable hierarchy. Tooth loss in itself impairs oral function, and both implant overdentures and implant-supported fixed prostheses can produce large improvements in patient-reported outcomes [14, 15]. Earlier observational work reported poorer OHIP scores with removable than with fixed restorations, but patient selection and baseline oral status differ systematically between modalities [35, 36]. In partially dentate older adults, several rehabilitation strategies improve OHRQoL, and treatment planning should remain individualized [37]. For stabilized OLP, implant therapy appears feasible, but the available evidence is heterogeneous and does not justify routine implant placement for the sole purpose of avoiding a removable prosthesis [16].

The sex difference, which reached conventional significance only in the severity-adjusted model, is consistent with some though not all OLP cohorts, in which women report greater symptom burden and poorer OHRQoL than men [6, 8]. It may reflect differences in symptom burden, psychological context, care-seeking behavior or unmeasured disease characteristics. Because the dataset used binary categories recorded as women and men and contained no information on how sex or gender was ascertained, this result should be interpreted with caution.

Future studies should recruit at patient level before prosthetic treatment, standardize the assessment of disease activity and prosthesis quality, and follow OHRQoL longitudinally. Within-patient pre-post designs or adequately powered prospective cohorts should record mucosal contact area, prosthesis fit and stability, oral hygiene, the number and distribution of missing teeth, implant status, nutritional status,

treatment expectations and psychological variables. Adoption of the recently published core outcome set for OLP would improve comparability across studies [38].

Strengths and limitations

The main strengths of this study are the histopathological confirmation of every diagnosis, independent severity grading by two experienced examiners with substantial to high agreement, use of the full 53-item OHIP-G rather than a short form, explicit reconstruction of the data at patient level, separation of the denture-specific items from the outcome, and sensitivity analyses addressing clinical severity, missing data, tooth-loss overlap and unequal visit frequency.

Several limitations are nevertheless important. First, the study is observational and the three prosthetic groups differed markedly in tooth loss, age and implant use, so residual confounding by indication is unavoidable. Second, the convenience sample was modest and complete-case adjustment reduced the primary model to 74 participants, resulting in wide confidence intervals. Third, prosthesis quality, timing of prosthetic treatment relative to OLP onset, lesion proximity to prosthetic components, systemic disease, medication, anxiety, socioeconomic factors, oral hygiene and functional chewing measures were not fully available. Fourth, 18 baseline participants had incomplete covariate data, mainly smoking status and tooth count. Although their OHIP-G scores and prosthetic-group distribution did not differ significantly from complete cases and multiple imputation yielded similar estimates, missing-at-random assumptions cannot be verified. Fifth, repeated visits were clinically driven rather than protocol-scheduled; the primary analysis therefore used one observation per patient, and repeated assessments were used only in a patient-balanced sensitivity analysis. Sixth, clinical subtype was derived from the CSI grade rather than assessed independently, so subtype and severity are not separate sources of information. Seventh, the three denture-specific items had to be excluded from the primary outcome; although this removes a structural bias, it also removes the only items that capture appliance-related discomfort directly, so a genuine mechanical effect confined to those items could not be distinguished from the scoring artifact. The resulting 50-item score is not itself a validated instrument; it correlated almost perfectly with the full 53-item score (r_S = 0.99, Table 3) and the use of population-adapted OHIP item sets is established practice [25], but its measurement properties were not examined separately. Eighth, the OHIP-G is a generic oral-health measure; disease-specific instruments such as the Chronic Oral Mucosal Disease Questionnaire may be more responsive to OLP-related change [6, 33]. Finally, the historical recruitment period may limit generalizability to current practice, and no analysis can establish causality from these data.

Conclusions

At the patient-level baseline assessment, participants with removable prostheses and those without a prosthesis had numerically poorer OHRQoL than participants with fixed prosthodontics, but all primary adjusted confidence intervals included the null. The direct removable-versus-no-prosthesis contrast was small, and the same pattern persisted after multiple imputation, restriction to the shared observed tooth-

loss range and patient-balanced analysis of repeated assessments. A measurable part of the crude difference between groups was attributable to denture-specific OHIP items rather than to disease burden. These findings do not support a causal OHRQoL disadvantage specific to removable appliances and are compatible with favorable selection into fixed prosthodontic rehabilitation. Clinical OLP severity was strongly associated with poorer OHRQoL in secondary analysis. Prospective patient-level studies beginning before prosthetic treatment and incorporating prosthesis quality, oral function, nutritional status and disease-specific patient-reported outcomes are required.

Abbreviations

CI
confidence interval
CSI
Clinical Severity Index
NHANES
National Health and Nutrition Examination Survey
OHIP-49
49-item Oral Health Impact Profile
OHIP-G
German version of the Oral Health Impact Profile
OHIP-G-50
OHIP-G total score excluding the three denture-specific items
OHIP-G-53
full 53-item OHIP-G total score
OHRQoL
oral health-related quality of life
OLP
oral lichen planus
Q1–Q3
first to third quartile
SD
standard deviation
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
VAS
visual analog scale

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. Data were collected in the course of routine clinical care, and their analysis was approved by the Ethics Committee of the Medical University of Vienna (EK No. 1198/2013). All participants gave written informed consent before inclusion.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Author Contribution

G.D. conceived and designed the study, supervised the project and acquired the clinical data. M.E. performed the statistical analysis and drafted the manuscript. L.Z. and S.H. contributed to the interpretation of the data. G.D., L.Z. and S.H. critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Acknowledgement

The authors thank Anne Hof, who collected the clinical data and analyzed them in her diploma thesis at the Medical University of Vienna, on which the present work builds. The authors also thank the patients who participated in this study and the staff of the University Clinic of Dentistry, Medical University of Vienna, and of the Department of Dermatology, Klinik Landstrasse, Vienna, where direct immunofluorescence was performed.

Availability of data and materials

The dataset generated and analyzed during the current study is not publicly available because it contains potentially identifiable clinical information. A de-identified dataset and the complete analysis script, sufficient to reproduce every reported estimate, are available from the corresponding author on

reasonable request, subject to approval by the responsible ethics committee and to applicable data-protection requirements.

References

1. Eisen D, Carrozzo M, Bagan Sebastian JV, Thongprasom K. Number V oral lichen planus: clinical features and management. Oral Dis. 2005;11:338–49. https://doi.org/10.1111/j.1601-0825.2005.01142.x.
2. González-Moles MÁ, Warnakulasuriya S, González-Ruiz I, González-Ruiz L, Ayen A, Lenouvel D, et al. Worldwide prevalence of oral lichen planus: a systematic review and meta-analysis. Oral Dis. 2021;27:813–28. https://doi.org/10.1111/odi.13323.
3. Warnakulasuriya S, Kujan O, Aguirre-Urizar JM, Bagan JV, González-Moles MÁ, Kerr AR, et al. Oral potentially malignant disorders: a consensus report from an international seminar on nomenclature and classification, convened by the WHO Collaborating Centre for Oral Cancer. Oral Dis. 2021;27:1862–80. https://doi.org/10.1111/odi.13704.
4. González-Moles MÁ, Ramos-García P. An evidence-based update on the potential for malignancy of oral lichen planus and related conditions: a systematic review and meta-analysis. Cancers (Basel). 2024;16:608. https://doi.org/10.3390/cancers16030608.
5. Yuwanati M, Gondivkar S, Sarode SC, Gadbail A, Sarode GS, Patil S, et al. Impact of oral lichen planus on oral health-related quality of life: a systematic review and meta-analysis. Clin Pract. 2021;11:272–86. https://doi.org/10.3390/clinpract11020040.
6. Wiriyakijja P, Porter S, Fedele S, Hodgson T, McMillan R, Shephard M, et al. Health-related quality of life and its associated predictors in patients with oral lichen planus: a cross-sectional study. Int Dent J. 2021;71:140–52. https://doi.org/10.1111/idj.12607.
7. Myers EL, McAlpine SG, Culton DA. Clinician and patient perspectives in oral lichen planus: correlation and drivers of disease severity and QOL. JID Innov. 2026;6:100424. https://doi.org/10.1016/j.xjidi.2025.100424.
8. Hashemipour MA, Sheikhhoseini S, Afshari Z, Gandjalikhan Nassab AR. The relationship between clinical symptoms of oral lichen planus and quality of life related to oral health. BMC Oral Health. 2024;24:556. https://doi.org/10.1186/s12903-024-04326-2.
9. Campana F, Lan R, Girard C, Rochefort J, Le Pelletier F, Leroux-Villet C, et al. French guidelines for the management of oral lichen planus (excluding pharmacological therapy). Ann Dermatol Venereol. 2022;149:14–27. https://doi.org/10.1016/j.annder.2021.04.003.
10. Bianco L, Romano F, Maggiora M, Bongiovanni L, Guzzi N, Curmei E, et al. Effect of sonic versus manual supervised toothbrushing on both clinical and biochemical profiles of patients with desquamative gingivitis associated with oral lichen planus: a randomized controlled trial. Int J Dent Hyg. 2019;17:161–9. https://doi.org/10.1111/idh.12377.
11. Eisen D. The clinical features, malignant potential, and systemic associations of oral lichen planus: a study of 723 patients. J Am Acad Dermatol. 2002;46:207–14.

https://doi.org/10.1067/mjd.2002.120452.

12. Erpenstein H. Periodontal and prosthetic treatment in patients with oral lichen planus. J Clin Periodontol. 1985;12:104–12. https://doi.org/10.1111/j.1600-051x.1985.tb01369.x.
13. Daume L, Kreis C, Bohner L, Jung S, Kleinheinz J. Clinical characteristics of oral lichen planus and its causal context with dental restorative materials and oral health-related quality of life. BMC Oral Health. 2021;21:262. https://doi.org/10.1186/s12903-021-01622-z.
14. Schierz O, Baba K, Fueki K. Functional oral health-related quality of life impact: a systematic review in populations with tooth loss. J Oral Rehabil. 2021;48:256–70. https://doi.org/10.1111/joor.12984.
15. Abou-Ayash S, Fonseca M, Pieralli S, Reissmann DR. Treatment effect of implant-supported fixed complete dentures and implant overdentures on patient-reported outcomes: a systematic review and meta-analysis. Clin Oral Implants Res. 2023;34(Suppl 26):177–95. https://doi.org/10.1111/clr.14065.
16. Li JW, Kot WY, McGrath CP, Chan BWA, Zheng LW. Stabilized oral lichen planus does not compromise dental implants survival: a systematic review and meta-analysis. Oral Dis. 2024;30:3850–65. https://doi.org/10.1111/odi.14964.
17. Thongprasom K, Luangjarmekorn L, Sererat T, Taweesap W. Relative efficacy of fluocinolone acetonide compared with triamcinolone acetonide in treatment of oral lichen planus. J Oral Pathol Med. 1992;21:456–8. https://doi.org/10.1111/j.1600-0714.1992.tb00974.x.
18. John MT, Patrick DL, Slade GD. The German version of the Oral Health Impact Profile – translation and psychometric properties. Eur J Oral Sci. 2002;110:425–33. https://doi.org/10.1034/j.1600-0722.2002.21363.x.
19. John MT, LeResche L, Koepsell TD, Hujoel P, Miglioretti DL, Micheelis W. Oral health-related quality of life in Germany. Eur J Oral Sci. 2003;111:483–91. https://doi.org/10.1111/j.0909-8836.2003.00079.x.
20. John MT, Hujoel P, Miglioretti DL, LeResche L, Koepsell TD, Micheelis W. Dimensions of oral-health-related quality of life. J Dent Res. 2004;83:956–60. https://doi.org/10.1177/154405910408301213.
21. John MT, Rener-Sitar K, Baba K, Celebić A, Larsson P, Szabo G, et al. Patterns of impaired oral health-related quality of life dimensions. J Oral Rehabil. 2016;43:519–27. https://doi.org/10.1111/joor.12396.
22. Long JS, Ervin LH. Using heteroscedasticity consistent standard errors in the linear regression model. Am Stat. 2000;54:217–24. https://doi.org/10.1080/00031305.2000.10474549.
23. White IR, Royston P, Wood AM. Multiple imputation using chained equations: issues and guidance for practice. Stat Med. 2011;30:377–99. https://doi.org/10.1002/sim.4067.
24. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370:1453–7. https://doi.org/10.1016/S0140-6736(07)61602-X.
25. Wojszko Ł, Banaszek K, Gagacka O, Bagińska J. Oral Health Impact Profile (OHIP) as a tool for the assessment of the oral health-related quality of life – a scoping review. Dent J (Basel). 2025;13:490.

https://doi.org/10.3390/dj13110490.

26. Zelig R, Goldstein S, Touger-Decker R, Firestone E, Golden A, Johnson Z, et al. Tooth loss and nutritional status in older adults: a systematic review and meta-analysis. JDR Clin Trans Res. 2022;7:4–15. https://doi.org/10.1177/2380084420981016.
27. Nitsuwat S, Webster J, Sarkar A, Cade J. The association of oral processing factors and nutrient intake in community-dwelling older adults: a systematic review and meta-analysis. Nutr Rev. 2025;83:e762–77. https://doi.org/10.1093/nutrit/nuae080.
28. Nowjack-Raymer RE, Sheiham A. Association of edentulism and diet and nutrition in US adults. J Dent Res. 2003;82:123–6. https://doi.org/10.1177/154405910308200209.
29. Toniazzo MP, Amorim PS, Muniz FWMG, Weidlich P. Relationship of nutritional status and oral health in elderly: systematic review with meta-analysis. Clin Nutr. 2018;37:824–30. https://doi.org/10.1016/j.clnu.2017.03.014.
30. Tay JRH, Kalhan AC, Cooray U, Nascimento GG. Impact of tooth preservation or replacement on diet quality: modified treatment policies approach. J Periodontal Res. 2026;61:283–91. https://doi.org/10.1111/jre.70053.
31. Tay JRH, Nascimento GG, Romandini M. Dental implant rehabilitation mitigates the increased mortality risk associated with tooth loss: a population-based study. J Periodontal Res. 2026. https://doi.org/10.1111/jre.70096.
32. Kalhan AC, Kalhan TA, Peres MA, Leite FR, Nascimento GG. Diet quality as a mediator linking tooth loss and cardiovascular diseases in older adults. J Periodontal Res. 2026;61:627–9. https://doi.org/10.1111/jre.70080.
33. Wiriyakijja P, Porter S, Fedele S, Hodgson T, McMillan R, Shephard M, et al. Meaningful improvement thresholds in measures of pain and quality of life in oral lichen planus. Oral Dis. 2020;26:1464–73. https://doi.org/10.1111/odi.13379.
34. Dvorak G, Rappersberger K, Rausch-Fan XH, Bruckmann C, Hofmann E. Effect of personality traits on oral health-related quality of life in patients with oral lichen planus undergoing treatment. Clin Oral Investig. 2021;25:2381–9. https://doi.org/10.1007/s00784-020-03561-5.
35. Reissmann DR, Sierwald I, Heydecke G, John MT. Interpreting one oral health impact profile point. Health Qual Life Outcomes. 2013;11:12. https://doi.org/10.1186/1477-7525-11-12.
36. Wickert M, John MT, Schierz O, Hirsch C, Aarabi G, Reissmann DR. Sensitivity to change of oral and general health-related quality of life during prosthodontic treatment. Eur J Oral Sci. 2014;122:70–7. https://doi.org/10.1111/eos.12107.
37. McKenna G, Allen PF, Hayes M, DaMata C, Moore C, Cronin M. Impact of oral rehabilitation on the quality of life of partially dentate elders in a randomised controlled clinical trial: 2 year follow-up. PLoS ONE. 2018;13:e0203349. https://doi.org/10.1371/journal.pone.0203349.
38. López-Pintor RM, Diniz-Freitas M, Ramesh SSK, Aguirre-Urizar JM, Bissonnette C, Carey B, et al. World Workshop on Oral Medicine VIII: development of a core outcome set for oral lichen planus: a

consensus study. Oral Surg Oral Med Oral Pathol Oral Radiol. 2023;135:792–803. https://doi.org/10.1016/j.oooo.2023.01.013.

Figures

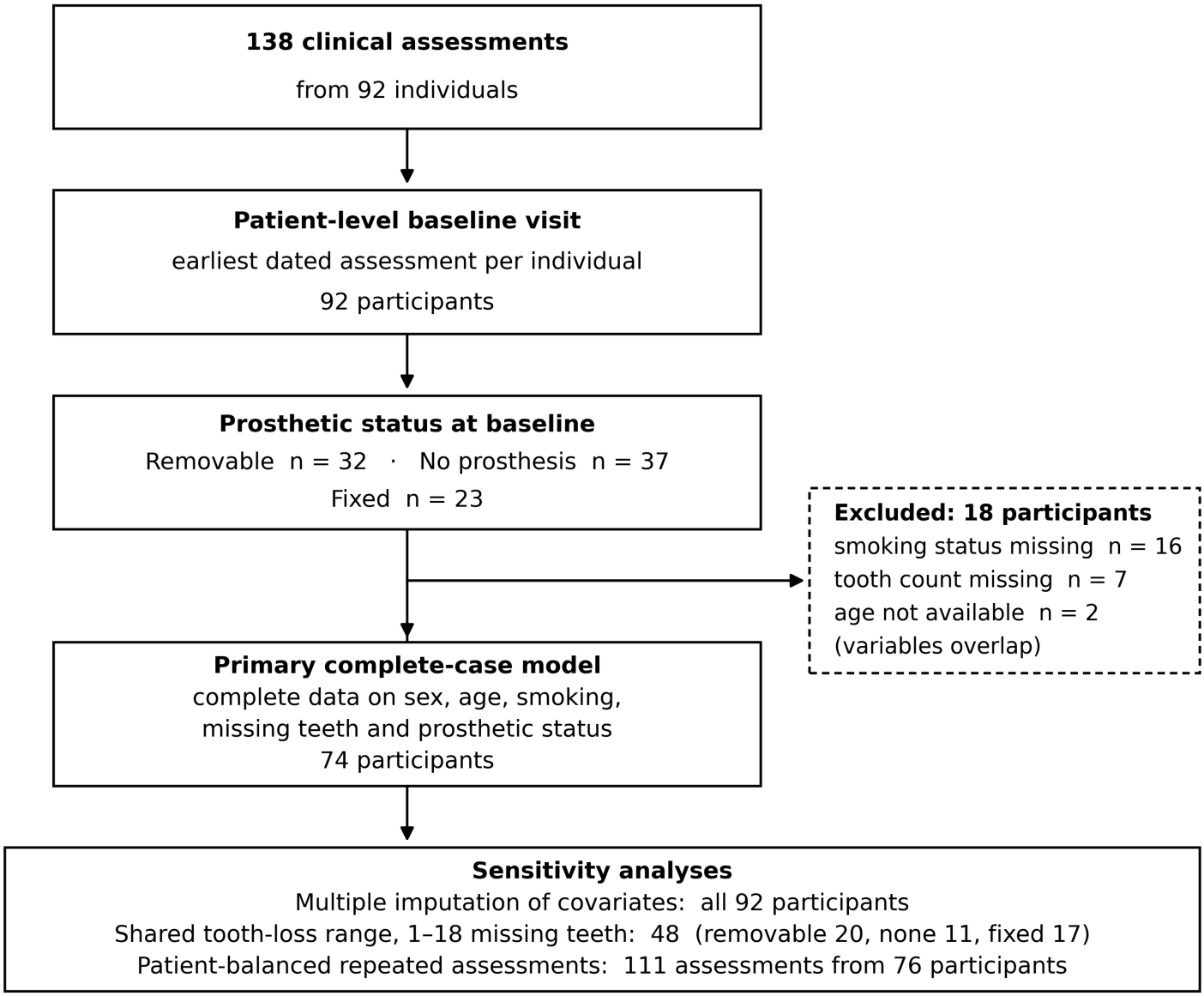


Figure 1

Flow of assessments and participants through the analysis. Boxes give the number of assessments or participants at each stage; the dashed box lists the reasons for exclusion from the primary complete-case model, which overlap between variables.

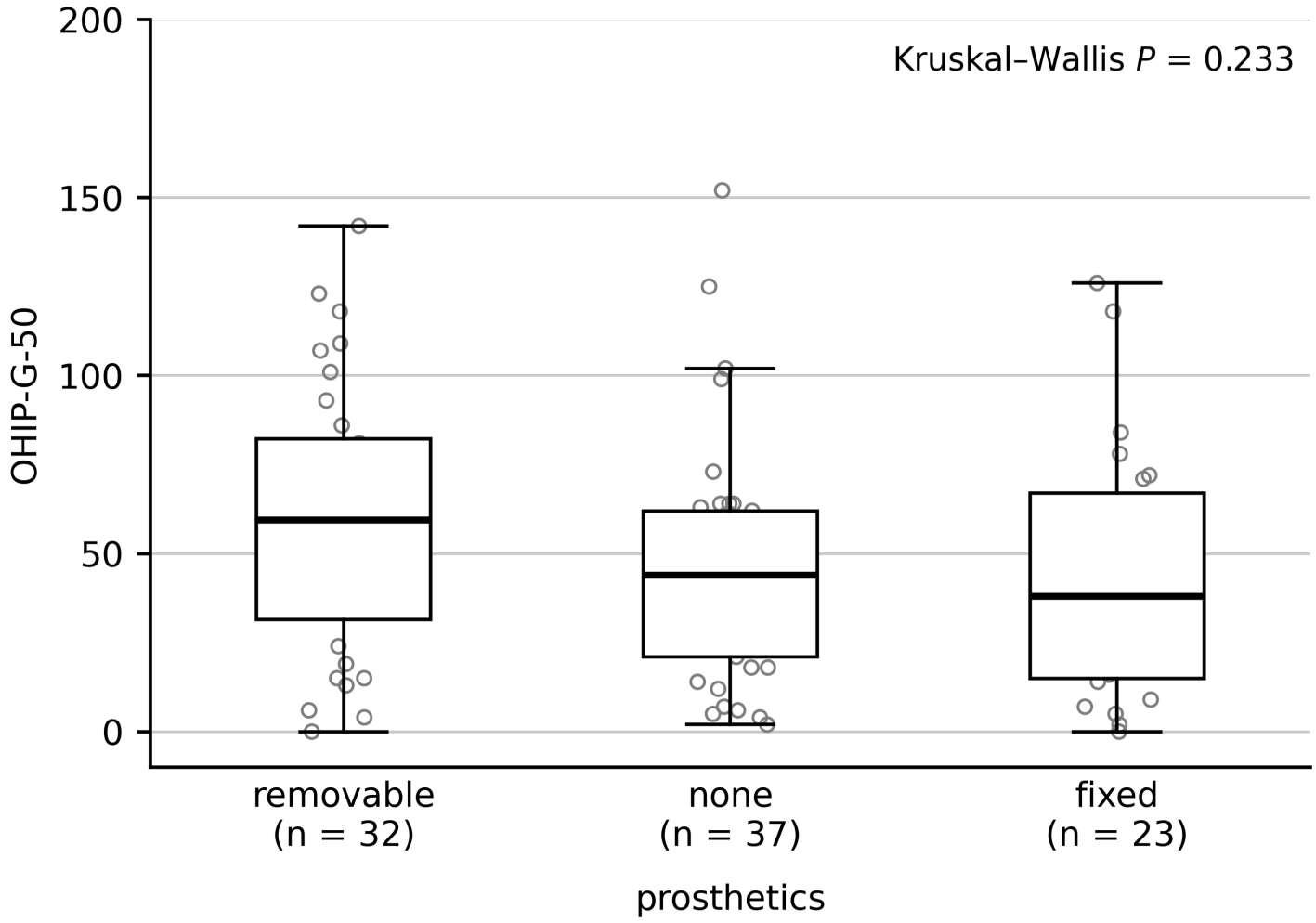


Figure 2

Oral health-related quality of life by prosthetic status at the baseline visit. Box plots show the median and interquartile range of the OHIP-G-50 total score (the 53-item OHIP-G excluding the three denture-specific items) for the 92 participants at their first eligible assessment; whiskers extend to the most extreme values within 1.5 times the interquartile range, and open circles show individual participants. Higher scores indicate poorer oral health-related quality of life. The difference between groups was not statistically significant (Kruskal-Wallis *P* = 0.233).

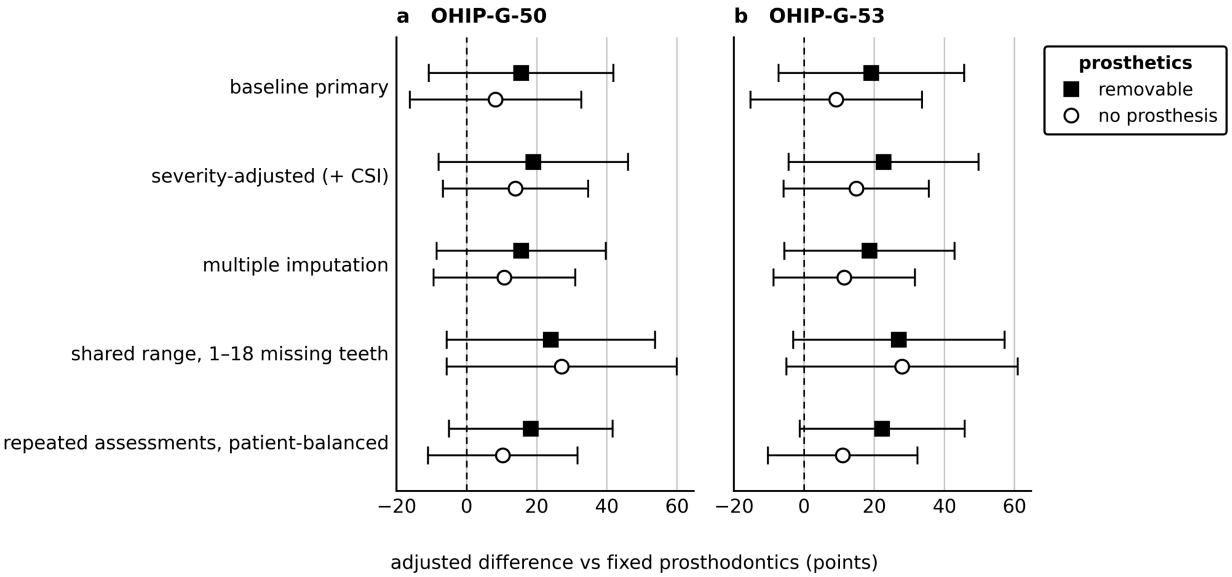


Figure 3

Adjusted difference in the OHIP-G total score versus fixed prosthodontics across the primary and sensitivity analyses. **a** Primary outcome, OHIP-G-50 (53 items excluding the three denture-specific items). **b** Sensitivity analysis using the full 53-item OHIP-G. Filled squares denote removable prostheses and open circles no prosthesis; horizontal lines are 95% confidence intervals. The baseline primary model uses one observation per participant, HC3 robust standard errors and adjustment for sex, age, smoking status and number of missing teeth. The severity-adjusted model additionally includes CSI. The multiple-imputation model pools 50 imputed baseline datasets using Rubin's rules. The shared-range analysis is restricted to participants with 1–18 missing teeth. The repeated-assessment sensitivity analysis weights each participant's eligible observations to sum to one and uses patient-clustered robust standard errors. Positive values indicate poorer oral health-related quality of life relative to fixed prosthodontics.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1STROBE.docx
- Additionalfile2.docx