

# Oral Health Related Quality of Life in Patients Received Fixed Prosthesis on Implants or Natural Teeth: comparative analysis

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**Abstract:** *Background:* Research has shown that health-related quality of life (OHRQoL) decreases when patients have their teeth extracted and that fixed denture replacements can improve it. This study investigates if the type of the underlying support, whether implant or natural teeth, can influence the OHRQoL in patients received three-unit or four-unit porcelain fused to metal (PFM) bridge.

**Methods:** A cross-sectional study was ethically approved and 167 participants with three-unit or four-unit bridges received on implants and on natural teeth were recruited to take part in the study. OHRQoL was determined using the validated Oral Health Impact Profile (OHIP-14). Information regarding demographics, medical conditions and tooth brushing habits were also obtained through structured questionnaires.

**Results:** One hundred and three participants responded to the questionnaire in this study with 61.7% response rate. The OHIP-14 median total score for the implants group was 6 (Range=0-26, 95% CI=6-10), and for the natural teeth group was 4 (Range=0-24, 95% CI=4-8). Both groups reported good OHRQoL after receiving fixed-bridge restorations, with better impact been reported by the group with the natural teeth support, however, no statistical significant difference detected in comparison to the implants group.

**Conclusion:** Both bridge types in this study appear to have equal impact on the OHRQoL since no statistically significant difference in OHIP-14 scores between the groups was identified. Therefore, one can conclude that the type of underlying support for fixed bridge whether implant or natural teeth, does not impact on the overall OHRQoL of the patient receiving the treatment.

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## **Introduction**

One of the most common treatments patients seek is the replacement of missing teeth resulted from trauma, dental caries or periodontal diseases. Patients with missing posterior teeth often complain of reduced masticatory function and discomfort, potentially affecting proper nutrition. [1; 2; 3] Teeth replacement signifies not only restoring the oral function but also regaining the self-esteem, social function and improvement in quality of life (QoL) and mental health well-being. [4, 5]

Several replacement options for missing teeth that benefit from natural teeth or dental implants in their support exist including removable partial dentures (RPDs), fixed partial dentures/bridges (FPDs). [6, 7] Tooth-supported FPDs (TFPD) are generally less invasive compared to implant-supported FPDs (IFPD) because the treatment duration is relatively short, and the abutment preparation can be performed within the same procedure. [4] Nevertheless, TFPD bridges require an irreversible abutment tooth preparation that can be destructive for the tooth structure, which is a common drawback of this treatment modality, compared to the IFPDs where no tooth

preparation is required. [6] Providing dental implant, however, has its own limitation including possible infections, delayed bone healing or prolonged bleeding, that can increase with smoking or certain systemic diseases such as uncontrolled diabetes mellitus or osteoporosis. [6, 8]

## **Oral health related quality of life of patients receiving fixed prostheses**

Several studies have found that FPD has a positive impact on patients' oral health related quality of life (OHRQoL) compared with RPD. [9; 10; 11; 12] However, studies comparing FDP based on type of underlying supporting structure reported that IFPD has better impact on patients' oral health life quality than TFPD. [13; 9; 12] Nevertheless, This was contradicted by one of the randomised controlled trial that investigated the OHRQoL in patients treated with shortened dental arch compared with those treated with RPD to replace lost molars. [14] The study concluded that the OHRQoL was not influenced by the type of prosthesis provided between both groups even after ten years, with no option being superior to the other, indicating that OHRQoL is improved regardless of the type of the restoration provided (**Table 1**). As there are conflicting

results in the literature, this study is substantiating the published evidence and investigating if FPD underlying support influence the reported OHRQoL.

**Table-1** Studies comparing the OHRQoL in patients with IFPD vs TFPD fixed

Author	Year of Publication	Study design	Sample size	Questionnaire	Outcome	Study's quality
Petricevic et al	2012	Longitudinal	164	OHIP-49	FPD improved QoL equally in both age groups ( $\leq 60$ , $>60$ ), IFPD improved QoL more in older age group	Potential apprehension bias, and unequal age distribution
Ali et al	2018	Systematic review & meta-analysis	-	OHIP-14, OHIP-49 & GOHAI	Overall IFPDs, IRPDs & FPDs improved QoL, RPDs improved QoL only short-term, no significant difference in QoL for ISCs	Limited evidence as only 2 RCTs identified for inclusion, only articles in English language included which introduced foreign language exclusion bias
Kurosaki et al	2021	Longitudinal	105	Validated questionnaire based on OHIP	IFPDs showed best survival rate and the only group with higher QoL than before treatment	Potential type 2 ( $\beta$ ) error as FPD & RPD groups small compared to IFPD group

Abbreviations: CCD: conventional complete denture, GOHAI: geriatric oral health assessment index, FPD: fixed partial denture, vs: versus, IFP: implant-supported fixed prosthesis, IFPD: implant-supported fixed partial denture, IOD: implant-supported overdenture, IRPD: implant-supported removable partial denture, ISC: implant-supported single crown, OHIP: oral health impact profile, QoL: quality of life, RPD: removable partial denture,  $\uparrow$ : improved.

### **Methodology:**

The purpose of the study is to compare the OHRQoL in patients received three or four units IFPD bridges with those who received TFPD (**Figure 1**). Therefore, a cross-sectional study was ethically approved by the relevant Research Ethics Committee in Malta and the UK (BP0196001/250621). Demographic information was obtained, and individuals aged 18 years or more who received PFM were recruited (n=167) from two private dental practices in Malta. Each participant was identified with a three (n=57 IFPDs, n=35 TFPD) or a four-unit (n=49 IFPDs, n=26 TFPD) PFM fitted between 1<sup>st</sup> January 2018 and 31<sup>st</sup> December 2020. Participations were excluded if they have FPDs shorter than three-unit or longer than four-unit, single implant unit, onlays, single tooth-supported crowns, Maryland bridges or non-PFM restorations.

**Figure-1** One of the participants with different stages of constructing IFPD.



The validated short version of Oral Health Impact Profile questionnaire (OHIP-14) was used in its two versions of English and Maltese languages and distributed for local and foreign patients. [15, 16] This assessing tool comprised of fourteen items distributed into seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. Each domain's score can range from 0 to 8 with an overall score for the questionnaire ranging from 0-56 where higher scores denotes worse OHRQoL. [15] Participants were instructed to answer the questionnaire with reference to the FPD fitted in 2018, 2019 or 2020 only to avoid historical bias. Participants were also asked to indicate the frequency of problems endured on a Likert scale that ranged from 0-4, where 0 is 'never', 1 is 'hardly ever', 2 is 'occasionally', 3 is 'fairly often' and 4 is 'very often'.

### **Survey dissemination strategy**

The English and Maltese versions of OHIP-14 were converted to an online survey using the Jisc Online Surveys, which was then disseminated as a password-protected link, to ensure data protection, and sent to eligible

participants who use email and was also posted on the practices' websites with weekly reminders. An invitation pack that included hard copy of both versions of OHIP-14 questionnaire with instructions to answer one version only, a prepaid envelope, and information leaflet of the survey was posted to those participants who do not use email or have invalid email address. The information leaflet highlighted the voluntarily, confidentiality and anonymity nature of participation.

A pilot study of the first 20 responses received, was conducted to validate an additional question about the demographics and type of underlying support, to the OHIP-14 questionnaire to help matching with the purpose of the survey. The amended form was re-disseminated to the eligible participants with information of the change and a request to complete the new version. Only data collected from the new version was included in the study.

### **Statistical analysis**

Power calculation was conducted using StatMate 2.00 (GraphPad, USA). Data was extracted by downloading Jisc tool into an excel sheet to create data tables assorted by IFPD and TFPD groups' responses for

comparison. Analytical statistics was carried out using GraphPad (Prism, USA) software programmer. Kolmogorov-Smirnov, D'Agostino, Pearson omnibus and Shapiro-Wilk normality tests were conducted to assess data distribution. Total OHRQoL score was described as median and range for each group along with 95% confidence interval (CI) values and percentage comparisons between the two groups was analyzed using Mann-Whitney U test Fisher's exact test. Responses were given on a five-rating scale: 0=never, 1=hardly ever, 2=occasionally, 3=fairly often, 4=very often in the questionnaire. The mean of items that comprised a domain, was calculated to obtain each domain score.<sup>[17]</sup>

### **RESULTS**

Data was collected from 1<sup>st</sup> – 31<sup>st</sup> August 2021. Out of 167 individuals who were invited for the study, 51 participants did not return the questionnaires, four invitation packs and three emails were undelivered due to incorrect details, two questionnaires were received after the deadline and four were considered invalid as responses of more than 20% of data were missing. Therefore, 103 participants out of the 167 invitees were

included in this study with 61.7% response rate.

GraphPad software was used for statistical analysis and the Kolmogorov-Smirnov normality test revealed p-values=0.0072 for the TFPD group and p-values=0.0017 for the IFPD group, indicating that the data set is not normally distributed. Shapiro-Wilk normality test (p-value<0.0001 for both groups) and D'Agostino & Pearson Omnibus test (p-value=0.0008 for TFPD group, p-value=0.0377 for IFPD group) confirmed the results.

Information of demographics (**Table-2**) including gender, age, level of education, tooth brushing method, medical conditions, number of extracted teeth and whether previous dental bridges had been fitted, were obtained. Regular tooth brushing using manual toothbrush was reported by 57.2% (n=59/103) of participants compared to electric toothbrush 28.2% (n=29/103) while 11.7% (n=12/103) of participants used a combination of manual and electric toothbrushing and two participants (1.9%, =2/103) reported not brushing at all. Individuals who reported a history of heart disease constituted 7.8% (n=8/103), blood pressure 10.7% (n=11/103) and diabetes

4.9% (n=5/103). For each demographic question asked, comparisons in percentages between both groups are displayed in table 1. Male participants had bridges installed on natural teeth in 38.9% of cases, while bridges were fitted on implants in 51.5% of cases. On natural teeth, 61.1% of females received a bridge, compared to 48.5% of those who had bridges fitted on implants.

A total of 64% (n=66/103) of participants had the IFPD, while 36% (n=37/103) were provided with TFPD. Out of which, 58.3% (n=60/103) were posterior and 41% (n=42/103) were anterior bridges.

**Table-2** Characteristics of participants in the implant supported fixed partial denture (IFPD) and tooth supported fixed partial denture (TFPD) groups.

Demographics	Subgroup	IFPD	TFPD
Gender	Male	51.5% (34/66)	38.9% (14/36)
	Female	48.5% (32/66)	61.1% (22/36)
Age	18-29	3.0% (2/66)	2.7% (1/37)
	30-39	6.1% (4/66)	8.1% (3/37)
	40-49	9.1% (6/66)	16.2% (6/37)
	50-59	10.6% (7/66)	10.8% (4/37)
	60-69	34.8% (23/66)	40.5% (15/37)
	70-79	27.3% (18/66)	13.5% (5/37)
	80-89	9.1% (6/66)	8.1% (3/37)
Education	90+	0.0% (0/66)	0.0% (0/37)
	Primary	15.2% (10/66)	8.1% (3/37)
	Secondary	47.0% (31/66)	35.1% (13/37)
	Tertiary	37.9% (25/66)	56.8% (21/37)
Toothbrushing	Manual	63.1% (41/65)	48.6% (18/37)
	Electric	26.2% (17/65)	32.4% (12/37)
	Both	9.2% (6/65)	16.2% (6/37)
	Don't brush	1.5% (1/65)	2.7% (1/37)
Teeth extracted	One	13.6% (9/66)	48.6% (18/37)
	Two or more	86.4% (57/66)	51.4% (19/37)
Place of bridge	Front of mouth	43.1% (28/65)	37.8% (14/37)
	Back of mouth	56.9% (37/65)	62.2% (23/37)
Number of FPD	One	46.2% (30/65)	51.4% (20/37)
	More than one	53.8% (35/65)	45.9% (17/37)

### Oral health related quality of life

**Domain 1: Functional limitation**

No participants reported pronouncing or taste problems due to their FPD. The oral function in the IFPD group (1.9,  $\pm 0.7$ ) was comparable to that of the TFPD group (2,  $\pm 0.6$ ) indicating no statistically significant difference ( $p > 0.05$ ) occurs in the oral function between both groups.

**Domain 2: Physical discomfort**

No participants reported painful aching or eating discomfort due to their FPD. The physical discomfort score in the IFPD group (2,  $\pm 0.9$ ) was comparable with TFPD group (1.8,  $\pm 0.9$ ) denoting that no statistically significant difference ( $p > 0.05$ ) occurs in this domain between both groups.

**Domain 3: Psychological discomfort**

The psychological discomfort score in the IFPD group (1.3,  $\pm 1$ ) was comparable with the TFPD group (1.8,  $\pm 1$ ), although this score was slightly higher in the TFPD than in the IFPD group, indicating discomfort, this difference was not statistically significant ( $p > 0.05$ ).

**Domain 4: Physical disability**

The physical disability score in the IFPD group (2,  $\pm 0.8$ ) was marginally higher than

the TFPD group (1.8,  $\pm 0.5$ ) indicating physical disability in the implant supported group, however, this difference is not statistically different ( $p > 0.05$ ).

**Domain 5: Psychological disability**

The psychological disability in the IFPD group (1.9,  $\pm 0.9$ ) was comparable to that in the TFPD group (1.8,  $\pm 0.7$ ) indicating no psychological difficulties or embarrassments were experienced in both groups ( $p > 0.05$ ).

**Domain 6: Social disability**

The social disability in the IFPD group (1.8,  $\pm 0.6$ ) was comparable to that of the TFPD group (0.9,  $\pm 0.5$ ) denoting that no statistically significant difference ( $p > 0.05$ ) occurs in this domain between both groups.

**Domain 7: Handicap**

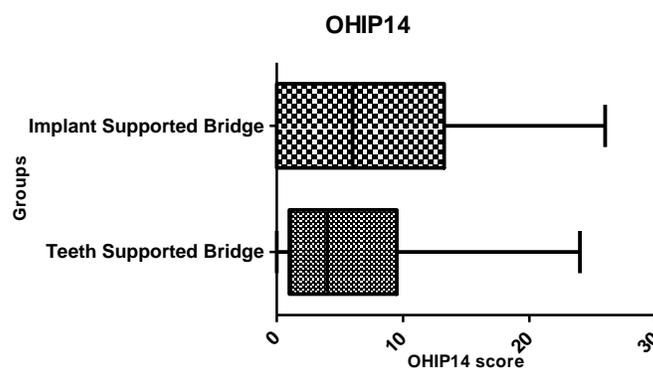
The oral handicap in the IFPD group was marginally higher (2,  $\pm 0.8$ ) than that in the TFPD group (1.8,  $\pm 0.6$ ) indicating that no statistically significant difference ( $p > 0.05$ ) occurs in this domain between both groups.

**Total OHIP-14**

The median score of OHIP-14 in the IFPD group (Median=6, 95% CI=6.2-9.9) was higher than the TFPD group (Median=4,

95% CI=3.9-8.1) (Table-3). Figure-2 illustrate the difference in the total OHIP-14 scores between IFPD and TFPD groups. Information of each response of OHIP-14 in both groups is illustrated in (table 4).

Figure-2 Whiskers (min to max) graph of the OHIP-14 scores of the implant supported fixed partial denture (IFPD) compared to the tooth supported fixed partial denture (TFPD) groups.



**Table-3** Comparison of OHIP-14 total scores between implant supported fixed partial denture (IFPD) and tooth supported fixed partial denture (TFPD) groups.

Statistics	IFPD n=66	TFPD n=37
Minimum	0.00	0.00
25% Percentile	0.00	1.00
Median	6.00	4.00
75% Percentile	13.25	9.50
Maximum	26.00	24.00
Mean	8.12	6.03
Standard deviation	7.64	6.38
Standard Error	0.94	1.05
Lower 95% CI	6.24	3.90
Upper 95% CI	9.99	8.15

**Table-4** Comparison of participants' responses for OHIP-14 between implant supported fixed partial denture (IFPD) and tooth supported fixed partial denture (TFPD) groups.

OHIP-14 question	Natural Teeth						Implants					
	Very often	Fairly often	Occasionally	Hardly ever	Never	Don't know	Very often	Fairly often	Occasionally	Hardly ever	Never	Don't know
<b>Trouble pronouncing words?</b>	0.0% (0/37)	0.0% (0/37)	2.7% (1/37)	21.6% (8/37)	73.0% (27/37)	2.7% (1/37)	0.0% (0/66)	0.0% (0/66)	9.1% (6/66)	12.1% (8/66)	78.8% (52/66)	0.0% (0/66)
<b>Sense of taste worsened?</b>	0.0% (0/37)	0.0% (0/37)	10.8% (4/37)	16.2% (6/37)	70.3% (26/37)	2.7% (1/37)	0.0% (0/66)	1.5% (1/66)	9.1% (6/66)	7.6% (5/66)	80.3% (53/66)	1.5% (1/66)
<b>Painful aching?</b>	0.0% (0/36)	2.8% (1/36)	22.2% (8/36)	36.1% (13/36)	33.3% (12/36)	5.6% (2/36)	0.0% (0/66)	6.1% (4/66)	25.8% (17/66)	21.2% (14/66)	47% (31/66)	0.0% (0/66)
<b>Uncomfortable to cut any foods?</b>	2.7% (1/37)	2.7% (1/37)	13.5% (5/37)	29.7% (11/37)	48.6% (18/37)	2.7% (1/37)	0.0% (0/66)	4.5% (3/66)	25.8% (17/66)	18.2% (12/66)	51.5% (34/66)	0.0% (0/66)
<b>Feel self-conscious?</b>	5.4% (2/37)	2.7% (1/37)	10.8% (4/37)	8.1% (3/37)	70.3% (26/37)	2.7% (1/37)	1.5% (1/66)	9.1% (6/66)	18.2% (12/66)	16.7% (11/66)	48.5% (32/66)	6.1% (4/66)
<b>Feel tense?</b>	5.4% (2/37)	0.0% (0/37)	13.5% (5/37)	18.9% (7/37)	51.4% (19/37)	10.8% (4/37)	1.6% (1/64)	10.9% (7/64)	18.8% (12/64)	21.9% (14/64)	43.8% (28/64)	3.1% (2/64)
<b>Diet unsatisfactory?</b>	0.0% (0/37)	0.0% (0/37)	5.4% (2/37)	13.5% (5/37)	78.4% (29/37)	2.7% (1/37)	1.5% (1/66)	0.0% (0/66)	7.6% (5/66)	12.1% (8/66)	78.8% (52/66)	0.0% (0/66)
<b>Have to interrupt meals?</b>	0.0% (0/36)	0.0% (0/36)	5.6% (2/36)	16.7% (6/36)	75% (27/36)	2.8% (1/36)	1.5% (1/65)	0.0% (0/65)	18.5% (12/65)	26.2% (17/65)	53.8% (35/65)	0.0% (0/65)
<b>Difficult to relax?</b>	0.0% (0/36)	0.0% (0/36)	8.3% (3/36)	30.6% (11/36)	58.3% (21/36)	2.8% (1/36)	0.0% (0/66)	3.0% (2/66)	13.6% (9/66)	28.8% (19/66)	53.0% (35/66)	1.5% (1/66)
<b>A bit embarrassed?</b>	0.0% (0/37)	2.7% (1/37)	13.5% (5/37)	16.2% (6/37)	64.9% (24/37)	2.7% (1/37)	0.0% (0/66)	4.5% (3/66)	22.7% (15/66)	19.7% (13/66)	53.0% (35/66)	0.0% (0/66)
<b>A bit irritable?</b>	0.0% (0/37)	0.0% (0/37)	2.7% (1/37)	8.1% (3/37)	81.1% (30/37)	8.1% (3/37)	0.0% (0/66)	0.0% (0/66)	9.1% (6/66)	12.1% (8/66)	72.7% (48/66)	6.1% (4/66)
<b>Difficulty doing usual jobs?</b>	0.0% (0/37)	0.0% (0/37)	2.7% (1/37)	13.5% (5/37)	78.4% (29/37)	5.4% (2/37)	0.0% (0/66)	0.0% (0/66)	6.1% (4/66)	16.7% (11/66)	74.2% (49/66)	3.0% (2/66)
<b>Life in general less satisfying?</b>	0.0% (0/37)	2.7% (1/37)	5.4% (2/37)	21.6% (8/37)	67.6% (25/37)	2.7% (1/37)	0.0% (0/66)	3.0% (2/66)	13.6% (9/66)	21.2% (14/66)	60.6% (40/66)	1.5% (1/66)
<b>Totally unable to function?</b>	0.0% (0/37)	0.0% (0/37)	5.4% (2/37)	8.1% (3/37)	83.8% (31/37)	2.7% (1/37)	0.0% (0/65)	3.1% (2/65)	7.7% (5/65)	9.2% (6/65)	80.0% (52/65)	0.0% (0/65)

## **DISCUSSION**

This study was conducted to investigate the impact of underlying support can have on OHRQoL in individuals received porcelain three-unit or four-unit FPD porcelain fused to metal fixed bridges. The assessment was administered through OHIP-14, and it revealed that regardless of the bridge underlying support, participants tolerated porcelain fused to metal fixed bridges equally. However, a pre-treatment assessment would have provided additional useful information.

In the current study, OHIP-14 scores were generally low, indicating satisfactory OHRQoL in both groups equally after receiving the IFPD or TFPD. These results agree with a previous study that assessed the OHRQoL pre-treatment, and post-treatment by three weeks and three years in patients received IFPD and TFPD. <sup>[13]</sup> The study found that OHIP-14 scores decreased significantly in both groups equally at the three-week post-treatment assessment and decreased further after three-year evaluation.

In a cohort study that evaluated the OHRQoL at three assessment points; pre-treatment, immediately post-treatment and six years after treatment, it was found that

OHRQoL was improved post-treatment compared to the pre-treatment assessment. <sup>[12]</sup> However, this longitudinal assessment concluded that a statistically significant higher level of OHRQoL after six years was only maintained by the IFPD group. The study assessed survival rates of the prostheses and concluded that the survival rate of IFPDs over six years was 94.7%, while that of TFPDs was 77.4%. This indicates that the decrease in perceived OHRQoL is not necessarily due to biological factors but could be referred to the structural damage of the TFPD.

As compared to the TFPD group, who experienced self-consciousness and meal interruptions in the current study, the IFPD group reported no concerns in the psychological discomfort and physical disability domains, albeit this difference was not determined to be statistically significant. Across all domains, slightly higher scores of OHIP-14 in the IFPD compared to TFPD group could be due to a negative impact of having a surgical procedure or potentially due costlier implant work that might increase expectations and decrease tolerance of minor issues.

In a study that assessed patient-reported problems before and after receiving prosthodontic treatment of FPD, RPD or complete denture, it was found that the problems were substantially reduced after receiving the treatment regardless of the type of prosthesis provided. <sup>[18]</sup> However, even though patients received FPD demonstrated better outcome, the study suggested that the participants continued to perceive enhanced OHRQoL for any type of tooth replacement.

There were no statistically significant differences between the different age groups in the scores obtained, despite the observation that some age groups were also less tolerant with OHIP domains than others. This is in line with a previous study where no statistically significant differences were reported between the age groups of 60 and >60. <sup>[13]</sup> However, in both short-term (3 weeks) and long-term (3 years) assessments, patients in the >60 age group in the IFPD group reported better OHRQoL. The presence or absence of other prosthesis can also be a confounding factor, since that a new prosthesis could well be adapted upon by participants with pre-existing prostheses considerably potentially more quickly.

Despite efforts to minimise the confounding factors it was not feasible to eliminate them fully, because this would have entailed a sample size that would be excessively small which would carry the risk of type II error. The study achieved acceptable participation rate and a sample size of 60 in one group and 30 in the other group was proven to have a similar power to a sample size of 40 in each group providing 95% power to detect a difference between means of 6.54 with significance level (alpha) of 0.05 (two-tailed) (StatMate 2.00, GraphPad, USA).

One of the main limitations of this study that it was conducted retrospectively with the possibility of recall bias because the treatments were completed eight months to three years earlier. Also, since only a post-operative questionnaire was administered, it is unclear whether or not the OHRQoL improved compared to the pre-treatment stage. Furthermore, OHIP questionnaire could be less sensitive in capturing the impact of short-span fixed prostheses, <sup>[10]</sup> this is because it only assesses negative impacts. <sup>[19]</sup> Nevertheless, this tool remains widely used in assessing OHRQoL worldwide. Our findings corroborate other studies with longer follow-up periods. <sup>[12]</sup>

Our results are in agreement with a recent systematic review where no difference between IFPD and TFPD on OHRQoL was found. [20] However, due to the limited literature in this field more primary studies assessing the impact of different prosthodontic treatments on OHRQoL is required to help assist clinicians and patients with their treatment decision.

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