

CLINICAL RESEARCH

Effect of fixed prosthetic restorations on early patient-reported outcomes following free gingival graft surgery: A prospective parallel-group clinical study



Serap Karakis Akcan, DDS, PhD,^a Busra Terzioğlu, DDS, PhD,^b and Berceste Guler Ayyildiz, DDS, PhD^c

Free gingival grafting (FGG) is a well-established mucogingival procedure with documented long-term stability for increasing keratinized tissue width.¹ Widely used for soft tissue phenotype modification,^{2,3} FGG involves donor and recipient sites and may cause early postoperative morbidity that temporarily impairs the oral health-related quality of life (OHRQoL).⁴⁻⁷ Treatment outcomes have been increasingly evaluated using patient-reported outcome measures (PROMs).⁸ Pain following palatal graft harvesting typically peaks in the early postoperative period and is influenced by patient-related factors such as sex, anxiety, and individual sensitivity.^{1,9-18} Strategies such as biologic agents, platelet concentrates, pre-emptive analgesia, and palatal protection have been proposed to reduce morbidity and analgesic use.¹⁹⁻²³

Fixed dental prostheses (FDPs) exert biological and mechanical influences on periodontal and pericervical

ABSTRACT

Statement of problem. Fixed dental prostheses create a different pericervical environment, yet studies comparing patient-reported outcome measures (PROMs) after free gingival grafting (FGG) between restored and nonrestored teeth remain limited.

Purpose. The purpose of this prospective parallel-group clinical study was to compare early postoperative PROMs, pain, and patient satisfaction after FGG in restored and nonrestored teeth.

Material and methods. This study included 49 systemically healthy participants undergoing FGG at sites with keratinized tissue width (KTW) <1 mm. The participants were allocated to a restored tooth group (RTG) or a nonrestored tooth group (NTG). Clinical parameters were recorded at baseline (T0) and at 30 days (T30). Graft dimensions were recorded intraoperatively. Postoperative pain, analgesic consumption, and PROMs using the Oral Health Impact Profile (OHIP-14) were assessed at T0, T1, T7, and T30.

Results. Baseline OHIP-14 scores (functional limitation and behavioral impact) were significantly higher in the RTG. Generalized estimating equation analysis showed a significant time effect for total OHIP-14 scores (Wald $\chi^2=32.943$, $P<.001$), with no significant group or interaction effects (group, $P=.102$; interaction, $P=.240$). Scores peaked at T1, improved by T7, and approached baseline at T30. Postoperative pain (Wald $\chi^2=55.074$, $P<.001$) and analgesic consumption (Wald $\chi^2=45.056$, $P<.001$) also showed significant time effects without group differences. Regression analysis identified mean analgesic consumption as the only predictor of patient satisfaction.

Conclusions. FGG produced comparable short-term outcomes in teeth with and without fixed dental prostheses. Although restored teeth showed poorer baseline quality of life, the postoperative experience was mainly influenced by pain intensity rather than prosthetic status. (J Prosthet Dent 2026;136:1121-1132)

soft tissues. The pericervical environment around FDPs differs from that of natural teeth. Restoration characteristics such as surface topography, marginal adaptation, and emergence profile are critical for soft tissue adaptation and may affect epithelial adhesion, connective tissue organization, plaque accumulation, and probing depth

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

^aAssistant Professor, Department of Periodontology, Faculty of Dentistry, Istanbul Gelisim University, Istanbul, Turkey.

^bAssistant Professor, Tavsanli Vocational School of Health Services, Kutahya Health Sciences University, Kutahya, Turkey; and Oral and Dental Health Application and Research Center, Kutahya Health Sciences University, Kutahya, Turkey.

^cAssociate Professor, Department of Periodontology, Faculty of Dentistry, Kutahya Health Sciences University, Kutahya, Turkey.

Clinical Implications

In patients with fixed dental prostheses, FGG may improve pericervical soft tissue conditions and early postoperative comfort. Short-term patient satisfaction appears to depend primarily on effective pain control, emphasizing the importance of individualized analgesic strategies.

(PD).^{24,25} Alterations in restorative contour may increase pericervical pressure and inflammatory responses, potentially compromising tissue stability.^{26–28} In addition, the physicochemical properties of restorative materials—including zirconia, metal-ceramic, and glass-ceramic systems—may influence epithelial adhesion, biofilm formation, and pericervical tissue response.^{26,29–31} These restorative factors may affect tissue phenotype, sensory perception, and wound healing following mucogingival surgery.^{32–34} Accordingly, surgical modification of the soft tissue phenotype around FDPs has been proposed as a clinically relevant approach to enhance tissue stability and patient comfort.³¹

Despite the growing emphasis on patient-reported outcomes in periodontal therapy, evidence directly comparing postoperative OHRQoL and patient satisfaction after FGG between restored and nonrestored teeth remains limited. Consequently, postoperative pain perception, functional recovery, and patient-reported experiences may differ between these 2 pericervical environments. Therefore, this study compared OHRQoL and patient satisfaction after FGG between teeth with and without FDPs. The primary aim was to evaluate PROM-based outcomes following FGG in 2 biologically distinct pericervical conditions. The secondary aim was to explore associations between clinical, surgical, and patient-related variables and outcomes. The null hypothesis was that no differences would be observed in OHRQoL or patient satisfaction between FGG procedures performed around restored and nonrestored teeth.

MATERIAL AND METHODS

This clinical trial was approved by the Istanbul Gelisim University Clinical Research Ethics Committee (Decision No. 2024–16–79), registered at ClinicalTrials.gov (NCT07167901), and conducted in accordance with the Declaration of Helsinki and CONSORT guidelines.³⁵ Written informed consent was obtained from all participants.

Participants were allocated into 2 groups according to prosthetic restoration at the target tooth: the non-restored tooth group (NTG) and the restored tooth group (RTG). The NTG included natural teeth without a

fixed dental prosthesis (FDP) and keratinized tissue width (KTW) <1 mm presenting Cairo RT1 gingival recession without root caries, cervical or proximal restorations, or noncarious cervical lesions and with preserved crown morphology.³⁶ The RTG comprised teeth restored with a complete crown or short-span (≤ 3 -unit) metal-ceramic or monolithic zirconia FDP with KTW <1 mm, meeting clinically acceptable prosthetic criteria (adequate marginal adaptation, absence of overhangs or open margins, and no bleeding or sup-puration on probing or supracrestal tissue attachment violation).^{26,27,29,31,37} To avoid clustering bias, only 1 eligible site per participant was included; when multiple sites met the criteria, the site with the greatest clinical need (participant complaint, inflammatory severity, and KTW deficiency) was selected. Participant-level inclusion criteria were age 18 to 65 years, systemic health, cooperation, and adequate oral hygiene (complete mouth plaque and bleeding scores <20%). Exclusion criteria included pregnancy, breastfeeding, previous mucogingival surgery, medications affecting wound healing or pain perception, bleeding disorders, anticoagulant therapy, allergies to local anesthetics or suture materials, severe malocclusion, parafunctional habits, and diagnosed psychological disorders. The primary surgical indication was KTW deficiency (<1 mm) regardless of prosthetic status, and gingival recession was recorded as a site characteristic rather than a determinant of group allocation. All participants received initial periodontal therapy and oral hygiene instruction, and, after a 4-week healing period, FGG procedures were performed by 2 calibrated periodontists (S.K.A. and B.G.A.) using an identical protocol to minimize operator bias.^{38,39}

Local anesthesia was administered. A horizontal incision was made at the mucogingival junction using a 15C blade and extended mesiodistally by 1 tooth width. A partial-thickness recipient bed was created by apical elevation of the vestibular mucosa, which was repositioned and stabilized apically to deepen the vestibule and create a vascularized recipient site. No tissue was excised during bed preparation. The mucosa was stabilized with 5–0 nonresorbable monofilament sutures (Trofilen; Doğsan). A 1.5- to 2.0-mm-thick graft was harvested, adapted, and stabilized at the recipient site with 5–0 monofilament sutures (Tekmon; Doğsan). Hemostasis at the donor site was achieved by pressure with moistened gauze followed by suturing, and a periodontal dressing (Coe-Pak; GC America) was applied only to the recipient site. Postoperatively, participants received a nonsteroidal anti-inflammatory drug (Flurbiprofen 100 mg; Sanovel) and were instructed to use a 0.12% chlorhexidine gluconate mouthrinse (Kloroben; Drog-san) twice daily for 14 days. Sutures were removed after 14 days (Fig. 1).

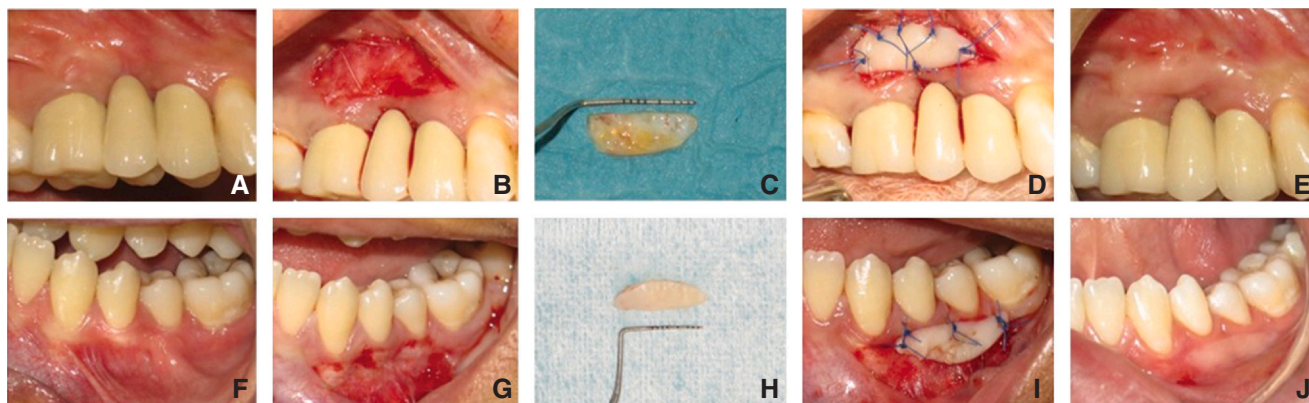


Figure 1. Surgical procedure and early healing. A-E, Images from RTG group; F-J, Images from NTG group. A, F, Preoperative view of surgical site. B, G, Preparation of recipient site. C, H, Harvested grafts. D, I, Stabilization of grafts. E, J, 1-month follow-up. All images correspond to single surgically treated site included in the analysis for each participant.

Data were recorded at baseline (T0), intraoperatively, and during follow-up visits. Age and sex were recorded at T0. Clinical parameters, including the gingival index (GI), plaque index (PI), PD, and clinical attachment level (CAL), were measured at 6 sites per tooth using a UNC-15 probe (Nordent Manufacturing) by 2 calibrated examiners (S.K.A. and B.G.A.) at T0 and T30. KTW was measured at the mid-buccal site using the same probe and recorded to the nearest 0.5 mm. Intraoperative variables included graft vertical height (GVH), horizontal width (GHW), thickness (GT), calculated graft volume (GV), recipient site location, and operative time. GVH and GHW represented the maximal apicocoronal and mesiodistal dimensions of the recipient bed. GT was measured at 5 standardized points using a manual caliper (0.1-mm precision) and standardized to 1.5 to 2.0 mm. GV was calculated as follows: $GV = GVH \times GHW \times GT$. Postoperative pain was self-recorded daily by patients from T1 to T7 using a visual analog scale (VAS; 0-100), and analgesic consumption was recorded on standardized forms; telephone reminders were used to enhance compliance.⁴⁰ OHRQoL was assessed at T0, T1, T7, and T30 using the OHIP-14 questionnaire, including pain and discomfort (PD), psychological impact (PI), functional limitation (FL), and behavioral impact (BI) domains.⁴¹ Patient satisfaction was evaluated at T30 using a 12-item dichotomous questionnaire.^{7,38,42} All questionnaires were completed by participants during follow-up visits under investigator supervision (Table 1).

Intra- and inter-examiner calibration was performed before enrollment on 10 non-study participants. Duplicate measurements of PD, CAL, PI, and GI were performed at 6 sites per tooth using a UNC-15 probe with a 48-hour interval. Graft-related measurements were similarly repeated using templates and manual calipers. Acceptable agreement was defined as <1 mm for periodontal measurements and <0.5 mm for graft

measurements, and intraclass correlation coefficients (ICC) were ≥ 0.80 .^{38,39,43,44}

The primary outcome was longitudinal change in PROMs (OHIP-14 and satisfaction). Secondary outcomes included surgical and clinical parameters and their associations with demographic and pain-related variables. Sample size had been calculated using a software program (G*Power version 3.1.9.2; Heinrich-Heine-Universität Düsseldorf).⁴⁵ In the absence of comparable studies, the standardized effect size was set at 0.35. A minimum of 44 participants was required for a repeated-measures ANOVA design with 4 time points and 2 groups, 95% confidence ($\alpha = .05$), and 80% power.⁴⁶ Considering a 10% to 15% drop-out rate, the target sample size was ≥ 49 participants; 54 participants had been enrolled at baseline.

Descriptive statistics were presented as number, percentage, mean $\pm$ standard deviation (SD), or median (interquartile range). Normality and variance homogeneity were assessed using the Shapiro-Wilk and Levene tests. Between-group comparisons used the independent samples *t* test or Mann-Whitney *U* test, and within-group comparisons used the Wilcoxon signed-rank test.

Associations between continuous variables were evaluated using the Pearson or Spearman correlations, and stepwise linear regression identified predictors of patient satisfaction. Categorical variables were analyzed using the Pearson χ^2 or Fisher exact tests. Longitudinal analyses of repeated PROM measurements, postoperative pain (VAS), and analgesic consumption were performed using generalized estimating equations (GEEs) with Poisson distribution and log link function. Group, time, and group $\times$ time interaction effects were assessed using Type III Wald χ^2 statistics, with Bonferroni-adjusted pairwise comparisons when appropriate. All analyses were performed using a statistical software program (IBM SPSS Statistics, v27; IBM Corp) ($\alpha = .05$).

Table 1. Distribution of positive and negative responses to the patient satisfaction questionnaire

No	Questions	Positive response (n)	Negative response (n)
1	Did the surgical treatment meet your expectations?	47	2
2	Are you able to use the treated area comfortably for chewing and speaking?	47	2
3	Did you experience any loss of sensation or numbness in the treated area post-surgery?	33	16
4	Do you believe that the surgical treatment contributed to the longevity of your tooth/implant?	47	2
5	Do you consider the appearance of the treated area to be more esthetic following the surgery?	42	7
6	Do you avoid brushing the surgical site because you fear damaging it?	26	23
7	Do you feel concerned about the visibility of the surgical site while speaking?	43	6
8	Did you perceive the surgical procedure to be difficult?	17	32
9	Do you consider the recovery time required to use the area to be prolonged comfortably?	35	14
10	Do you consider the preoperative information provided adequate?	48	1
11	Would you consider undergoing the same surgical treatment again if indicated for another site?	43	6
12	Would you recommend this surgical procedure to a friend or relative?	47	2

RESULTS

A total of 54 participants were enrolled (NTG: $n=29$; RTG: $n=25$). During follow-up, 5 participants were lost (NTG: $n=2$; RTG: $n=3$) because of missed visits, relocation, or a newly diagnosed systemic condition. Consequently, 49 participants (33 women, 16 men) completed the 30-day follow-up (NTG: $n=27$; RTG:

$n=22$), with a mean $\pm$ standard deviation age of 41.08 ± 10.16 years. The CONSORT flow diagram is presented in Figure 2, and characteristics are summarized in Table 2. No significant intergroup differences were observed for sex ($P=.468$) or jaw location ($P=.314$). However, surgical site distribution differed, with procedures performed more frequently in posterior regions in the RTG and anterior regions in the NTG ($P=.005$).

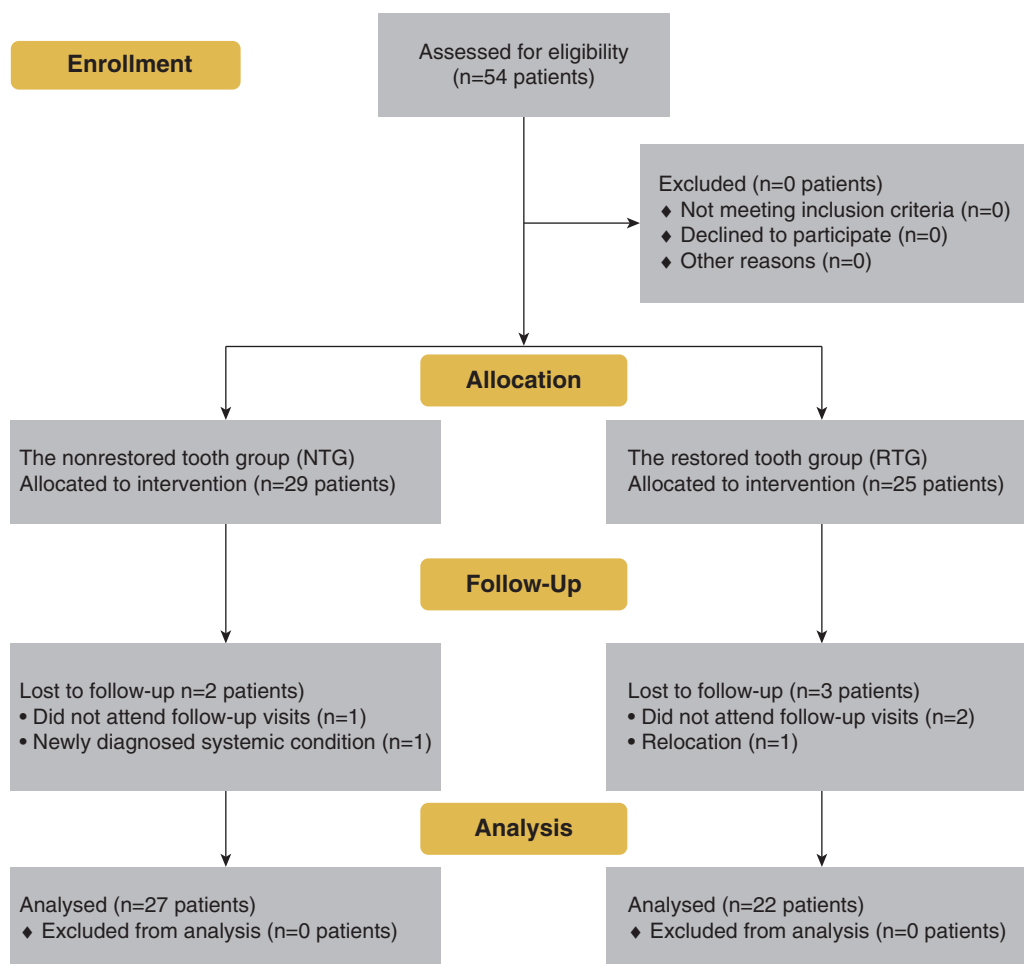
**Figure 2.** Study flow-chart.

Table 2. Demographic and operative measurements by study group

	Group	n	%	Test Statistic	P	Effect Size
Men	NTG	10	37.0%	0.526	.468	
	RTG	6	27.3%			
Women	NTG	17	63.0%	.314		
	RTG	16	72.7%			
Mandible	NTG	26	96.3%	.***		
	RTG	19	86.4%			
Maxilla	NTG	1	3.7%	7.933	.005*	
	RTG	3	13.6%			
Anterior	NTG	17	63.0%			
	RTG	5	22.7%			
Posterior	NTG	10	37.0%			
	RTG	17	77.3%			
Age	Group	Mean $\pm$ SD	Median (Q1-Q3)	Test Statistic	P	Effect Size
	NTG	36.07 $\pm$ 10	36 (28-43)	-4.533†	<.001*	1.302
	RTG	47.23 $\pm$ 6.36	46 (43-53)			
Graft thickness	NTG	1.63 $\pm$ 0.26	1.5 (1.5-2)	-0.537	.591	-
	RTG	1.59 $\pm$ 0.25	1.5 (1.5-1.5)			
Graft horizontal width	NTG	15.56 $\pm$ 4.82	14 (12-20)	-2.861	.004*	0.849
	RTG	19.3 $\pm$ 3.83	20 (15.5-23)			
Graft vertical height	NTG	6.81 $\pm$ 1.03	6.5 (6-7.5)	-4.518	<.001*	1.526
	RTG	5.41 $\pm$ 0.77	5 (5-5.5)			
Graft volume	NTG	172.72 $\pm$ 68.51	160.88(126-189.75)	-0.111	.912	-
	RTG	161.45 $\pm$ 24.6	165.38(142.5-180)			
Surgery duration	NTG	65.26 $\pm$ 17.14	63 (54-75)	2.188†	.034*	0.594
	RTG	56.82 $\pm$ 9.38	56 (50-64)			
Satisfaction	NTG	9.52 $\pm$ 1.78	10 (9-11)	-0.667	.505	-
	RTG	9.82 $\pm$ 1.65	10 (9-11)			

* $P < .05$. Pearson Chi Square, **Fisher Exact test and, Mann Whitney U tests, †Independent Samples T test. NTG, nonrestored tooth group; RTG, restored tooth group.

Intergroup comparisons showed significant differences in age, GHW, GVH, and operative time ($P < .05$). RTG participants were older and had greater GHW, whereas NTG sites showed longer operative times and greater GVH. No significant differences were observed for GT ($P = .591$) or GV ($P = .912$).

Time-dependent changes in clinical parameters are presented in Table 3. PD was significantly higher in the

RTG than in the NTG at T0 and T30 ($P < .05$), whereas baseline PI was higher in the NTG ($P < .05$). In both groups, PD and CAL decreased from T0 to T30, while KTW increased from T0 to T30 ($P < .05$).

The distribution of OHIP-14 domain and total scores across groups and time points is presented in Table 4. At baseline, OHIP-14-BI, OHIP-14-FL, and total OHIP-14 scores were higher in the RTG than in the NTG ($P < .05$).

Table 3. Comparison of clinical measurements by study group and time

		NTG		RTG		Intergroup		
		Mean $\pm$ SD	Median (Q1-Q3)	Mean $\pm$ SD	Median (Q1-Q3)	Test Statistics	P	Effect Size
Plaque index	T0	0.70 $\pm$ 0.77	0.5(0.33-0.66)	0.35 $\pm$ 0.69	0(0-0.5)	-2.584	.010*	0.486
	T30	0.81 $\pm$ 1.72	0.5(0.1-0.6)	0.51 $\pm$ 0.71	0.33(0-0.66)	-0.439	.661	-
	Test	-1.396	0.163	-1.601	0.109			
	Statistic / P							
Gingival index	T0	0.95 $\pm$ 1.82	0.5(0-1)	0.67 $\pm$ 0.74	0.58(0-1)	-0.186	.853	-
	T30	0.43 $\pm$ 1.01	0.1(0-0.33)	0.44 $\pm$ 0.45	0.42(0-1)	-1.183	.237	-
	Test	-1.674	0.094	-1.381	0.167			
	Statistic / P							
Probing depth	T0	1.61 $\pm$ 0.49	2(1-2)	2.57 $\pm$ 1.55	2(2-3)	-3.762	<.001*	0.874
	T30	1.41 $\pm$ 0.50	1(1-2)	2.32 $\pm$ 1.29	2(2-3)	-3.423	.001*	0.972
	Test	-2.333	0.020*	-2.049	0.040*			
	Statistic / P							
Clinical attachment level	T0	0.511		0.437				
	T30	3.91 $\pm$ 2.24	4(2-5)	2.84 $\pm$ 1.77	2(2-3)	-1.663	.096	-
	Test	3.15 $\pm$ 1.77	3(2-4)	2.59 $\pm$ 1.50	2(2-3)	-1.212	.225	-
	Statistic / P	-3.656	<0.001*	-2.049	0.040*			
Gingival width	T0	0.948		0.437				
	T30	1.33 $\pm$ 1.41	1(0-2)	0.64 $\pm$ 0.95	0(0-1)	-1.942	.052	-
	Test	6.19 $\pm$ 1.27	6(5-7)	5.45 $\pm$ 1.79	5(4-7)	-1.619	.106	-
	Statistic / P	-4.563	<0.001*	-4.035	<0.001*			
		Effect Size	3.700	Effect Size	3.452			

* $P < .05$. Mann-Whitney U and Wilcoxon signed-rank tests. NTG, non-restored tooth group; RTG, restored tooth group; SD, standard deviation; T0, before operation; T30, 30 days after operation.

Table 4. Descriptive statistics of OHIP-14 scores, VAS pain levels, and analgesic consumption across study groups over time

		T0-Mean ±SD/	Median (Q1-Q3)	T1-Mean ±SD/	Median (Q1-Q3)	T7-Mean ±SD/	Median (Q1-Q3)	T30-Mean ±SD/	Median (Q1-Q3)
OHIP-14-PD	NTG	2.56 ±1.65	2(1-4)	4.67 ±2.48	4(3-7)	2.63 ±2.37	2(1-4)	1.96 ±2.07	1(0-4)
	RTG	3.36 ±2.30	3.5(2-5)	5.09 ±2.86	4.5(3-6)	2.86 ±2.46	3(0-4)	2.95 ±2.30	3(2-4)
OHIP-14-PI	NTG	5.37 ±4.1	5(2-8)	6.41 ±4.09	6(3-9)	4.59 ±3.34	4(2-7)	4.67 ±3.28	4(2-7)
	RTG	6.73 ±4.00	6.5(4-10)	6.77 ±3.95	6(5-9)	4.86 ±3.58	5(3-6)	5.64 ±2.87	5.5(3-8)
OHIP-14-BI	NTG	2.41 ±2.87	2(0-4)	5.07 ±4.86	4(1-7)	3.11 ±3.80	2(0-5)	1.93 ±2.43	1(0-3)
	RTG	4.68 ±4.11	4(2-6)	6.00 ±4.19	6(4-9)	3.77 ±4.03	3(0-5)	3.55 ±3.05	3.5(0-5)
OHIP-14-FL	NTG	0.70 ±1.27	0(0-1)	2.93 ±2.89	3(0-4)	1.37 ±1.64	1(0-2)	1.04 ±1.22	0(0-2)
	RTG	2.00 ±2.65	1(0-2)	3.64 ±2.77	3(2-5)	2.36 ±2.50	2(0-4)	1.36 ±1.53	1(0-2)
OHIP-14-T	NTG	11.04 ±7.63	9(6-16)	18.63 ±11.4	20(7-25)	11.70 ±9.69	10(4-20)	9.70 ±7.67	7(4-15)
	RTG	16.77 ±10.46	16(9-20)	21.05 ±10.53	18(14-25)	14.00 ±10.84	12(5-17)	13.00 ±7.64	13.5(6-18)
P		.031*							

		T1-Mean ±SD/	M(Q1-Q3)	T2-Mean ±SD/	M(Q1-Q3)	T3-Mean ±SD/	M(Q1-Q3)	T4-Mean ±SD/	M(Q1-Q3)	T5-Mean ±SD/	M(Q1-Q3)	T6-Mean ±SD/	M(Q1-Q3)	T7-Mean ±SD/	M(Q1-Q3)
VAS	NTG	51.04 ±29.13	52(27-73)	36.00 ±29.63	21(10-61)	30.59 ±28.49	19(8-52)	28.15 ±29.99	11(6-50)	22.85 ±23.22	13(6-39)	22.00 ±26.99	8(4-37)	15.85 ±26.24	5(0-10)
	RTG	43.59 ±21.68	50(28-60)	23.41 ±20.83	16(9-41)	18.82 ±21.40	12.5(5-23)	18.64 ±22.99	12.5(0-30)	11.91 ±17.58	6.5(0-14)	12.41 ±22.37	3.5(0-12)	11.14 ±22.71	2.5(0-7)
Analgesic Consumption	NTG	1.96 ±1.09	2(1-3)	1.56 ±1.19	1(1-2)	1.15 ±1.17	1(0-2)	1.04 ±1.06	1(0-2)	0.78 ±0.93	0(0-2)	0.52 ±0.89	0(0-1)	0.33 ±0.73	0(0-0)
	RTG	1.82 ±0.73	2(1-2)	1.18 ±1.05	1(0-2)	0.95 ±0.95	1(0-2)	0.82 ±1.05	0.5(0-1)	0.41 ±0.8	0(0-1)	0.36 ±0.66	0(0-1)	0.27 ±0.63	0(0-0)

**P* < .05. Independent samples *t* test and Mann-Whitney *U* test. Mean ±SD, mean and standard deviation; M (Q1-Q3), median and interquartile range; NTG, nonrestored tooth group; OHIP-14-PD, pain and discomfort; OHIP-14-PI, psychological impact; OHIP-14-FL, functional limitation; OHIP-14-BI, behavioral impact; OHIP-T, total OHIP-14 score; RTG, restored tooth group; T0, before operation; T1, 1 day after operation; T7, 7 days after operation; T30, 30 days after operation; VAS, visual analog scale.

Table 5. Generalized estimating equation (GEE) analysis of OHIP-14 scores, VAS pain levels, and analgesic consumption across study groups and time points

Outcome	Group (Wald χ^2 , P)	Time (Wald χ^2 , P)	Group $\times$ Time (Wald χ^2 , P)
OHIP-14-PD	1.656; .198	36.096; <.001*	2.475; .480
OHIP-14-PI	0.773; .379	12.377; .006*	2.144; .543
OHIP-14-BI	3.523; .061	21.344; <.001*	4.889; .180
OHIP-14-FL	3.810; .051	41.879; <.001*	5.537; .136
OHIP-14 T	2.676; .102	32.943; <.001*	4.210; .240
VAS	2.084; .149	55.074; <.001*	8.241; .221
Analgesic Consumption	0.871; .351	45.056; <.001*	5.375; .497

* $P < .05$. Type III Wald χ^2 statistics are presented for group, time, and group $\times$ time effects. OHIP-14-PD, pain and discomfort; OHIP-14-PI, psychological impact; OHIP-14-FL, functional limitation; OHIP-14-BI, behavioral impact; OHIP-T, total OHIP-14 score; VAS, visual analog scale.

Table 6. Bonferroni-adjusted pairwise comparisons of OHIP-14 domain and total scores across time points

	I	J	Mean difference (I-J)	P
OHIP-14-PD	T0	T1	-1.942	<.001*
	T0	T7	0.188	>.999
	T0	T30	0.524	.241
	T1	T7	2.130	<.001*
	T1	T30	2.466	<.001*
	T7	T30	0.336	>.999
OHIP-14-PI	T0	T1	-0.577	>.999
	T0	T7	1.285	.043*
	T0	T30	0.882	.463
	T1	T7	1.861	.003*
	T1	T30	1.459	.074
	T7	T30	-0.402	>.999
OHIP-14-BI	T0	T1	-2.160	.005*
	T0	T7	-0.069	>.999
	T0	T30	0.744	.652
	T1	T7	2.092	.008*
	T1	T30	2.905	<.001*
	T7	T30	0.813	.524
OHIP-14-FL	T0	T1	-2.076	<.001*
	T0	T7	-0.613	.050
	T0	T30	-0.003	>.999
	T1	T7	1.462	<.001*
	T1	T30	2.073	<.001*
	T7	T30	0.611	.056
OHIP-14-T	T0	T1	-6.195	<.001*
	T0	T7	0.805	>.999
	T0	T30	2.374	.122
	T1	T7	7.000	<.001*
	T1	T30	8.569	<.001*
	T7	T30	1.569	.953

* $P < .05$. Pairwise comparisons between time points performed following significant time effects in GEE model using Bonferroni correction. OHIP-14-PD, pain and discomfort; OHIP-14-PI, psychological impact; OHIP-14-FL, functional limitation; OHIP-14-BI, behavioral impact; OHIP-14-T, total OHIP-14 score; T0, baseline; T1, postoperative day 1; T7, postoperative day 7; T30, postoperative day 30.

GEE analysis demonstrated a significant time effect for total OHIP-14 scores (Wald $\chi^2=32.943$, $P < .001$) and all domains: OHIP-14-PD (Wald $\chi^2=36.096$, $P < .001$), OHIP-14-PI (Wald $\chi^2=12.377$, $P = .006$), OHIP-14-BI (Wald $\chi^2=21.344$, $P < .001$), and OHIP-14-FL (Wald $\chi^2=41.879$, $P < .001$). No significant main effect of group or group $\times$ time interaction was observed (Table 5). Bonferroni-adjusted comparisons showed peak scores at T1, which were significantly higher than those at T7 and T30 across all domains and total scores ($P < .001$). OHIP-14-FL, OHIP-14-BI, and OHIP-14-PD increased from T0 to T1 ($P < .01$), whereas OHIP-14-PI differed between

T0 and T7 ($P = .043$) and between T1 and T7 ($P = .003$). No differences were observed between T0 and T30 or between T7 and T30 ($P > .05$) (Table 6).

Descriptive distributions of postoperative pain (VAS) and analgesic consumption are presented in Table 4. VAS peaked on postoperative day 1 (51.04 ± 29.13 in the NTG; 43.59 ± 21.68 in the RTG) and declined to 15.85 ± 26.24 and 11.14 ± 22.71 , respectively, by day 7. GEE analysis showed a significant time effect for both VAS (Wald $\chi^2=55.074$, $P < .001$) and analgesic consumption (Wald $\chi^2=45.056$, $P < .001$), without significant group or group $\times$ time interaction effects (Table 5). Bonferroni-adjusted comparisons indicated significantly higher values in the early postoperative period. T1 scores were higher than all subsequent time points ($P < .001$). VAS values at T2–T4 remained significantly higher than those at T5–T7 ($P < .001$). Similarly, analgesic consumption was significantly higher at T1 than at T2–T7, and values at T3–T4 remained higher than those at T5–T7 ($P < .001$) (Table 7).

Subgroup analyses showed no differences in satisfaction according to sex or surgical site ($P > .05$) (Table 8). In the NTG, women had higher OHIP-14 scores than men at T0, T1, and T7 ($P < .05$). No differences were found between anterior and posterior or maxillary and mandibular sites in either group (Table 9). Correlation analyses are presented in Tables 10 to 12. In the overall sample, T1 total OHIP-14 scores correlated positively with analgesic consumption ($r = 0.322$, $P = .024$), while OHIP-14-PD at T7 correlated with VAS ($r = 0.461$, $P < .001$). No significant correlations were identified in the NTG. In the RTG, VAS at T1 correlated with total OHIP-14 and OHIP-14-PD, and analgesic consumption showed a weak positive correlation with total OHIP-14 ($P < .05$). Demographic and surgical analyses (Table 11) showed a positive correlation between age and T30 total OHIP-14 ($r = 0.330$, $P = .021$). In the NTG, KTW at T30 correlated negatively with T0 OHIP-14 ($r = -0.419$, $P = .030$), whereas in the RTG age correlated with T7 OHIP-14 and KTW at T30 correlated positively with T0 OHIP-14 ($r = 0.461$, $P = .031$).

Stepwise linear regression identified mean analgesic consumption as the only significant predictor of patient satisfaction (Table 13). The model was significant

Table 7. Bonferroni-adjusted pairwise time comparisons of VAS and analgesic consumption scores

I	J	VAS		Analgesic Consumption	
		Mean difference (I-J)	P	Mean difference (I-J)	P
T1	T2	18.138	<.001*	0.533	.001*
T1	T3	23.174	<.001*	0.842	<.001*
T1	T4	24.264	<.001*	0.968	<.001*
T1	T5	30.671	<.001*	1.325	<.001*
T1	T6	30.645	<.001*	1.455	<.001*
T1	T7	33.881	<.001*	1.588	<.001*
T2	T3	5.036	.073	0.309	.002*
T2	T4	6.126	.221	0.435	.021*
T2	T5	12.533	<.001*	0.792	<.001*
T2	T6	12.507	.001*	0.922	<.001*
T2	T7	15.743	<.001*	1.054	<.001*
T3	T4	1.090	>.999	0.126	>.999
T3	T5	7.497	<.001*	0.483	.001*
T3	T6	7.471	.009*	0.613	<.001*
T3	T7	10.707	<.001*	0.745	<.001*
T4	T5	6.407	.006*	0.357	.018*
T4	T6	6.381	.044*	0.487	.004*
T4	T7	9.617	<.001*	0.620	<.001*
T5	T6	-0.026	>.999	0.130	>.999
T5	T7	3.210	>.999	0.263	.052
T6	T7	3.236	.024*	0.133	.249

* $P < .05$. Bonferroni-adjusted pairwise comparisons performed following GEE analysis. T1-T7, postoperative time points; VAS, visual analog scale.

($F=17.189$, $P < .001$) and explained 25.2% of the variance. Each additional analgesic tablet was associated with a 1.19-point decrease in satisfaction. Regression coefficients with 95% confidence intervals were reported, and all model assumptions were verified before interpretation. No autocorrelation was detected (Durbin--Watson=1.783).

DISCUSSION

The null hypothesis that no differences would be observed in OHRQoL or patient satisfaction between FGG procedures performed around restored and nonrestored teeth was not rejected because no significant differences were detected in longitudinal OHIP-14 scores or patient satisfaction between teeth with and without FDPs

following FGG. Overall, early postoperative patient experience appeared to be driven primarily by pain intensity and analgesic consumption rather than by prosthetic status.

The biological and mechanical effects of FDPs on periodontal tissues have been well documented.³⁰⁻³² Restoration characteristics such as emergence profile volume and microgaps at the restoration-tissue interface may alter pericervical biomechanics, increase sensorimotor awareness, and negatively influence discomfort perception.^{29,30} Consistent with this, higher baseline OHIP-14 scores in the RTG, particularly in the BI and FL domains, suggested that restoration-related factors may adversely affect perceived QoL before surgery. Pontic design, restorative volume, and cleanability can influence pericervical pressure and phenotypic stability.²⁴⁻²⁶ Nevertheless, a consensus report from the American

Table 8. Comparison of satisfaction scores in study groups according to sex and operation area

			Mean $\pm$ SD	Median (Q1-Q3)	Test Statistic	P
NTG	Sex	Men	10.30 $\pm$ 1.16	10(9-11)	-1.511	.141
		Women	9.06 $\pm$ 1.95	10(8-10)		
	Operation Area	Mandible	9.50 $\pm$ 1.82	10(9-11)	-	-
		Maxilla	10.00 $\pm$ 0.00	10(10-10)		
		Anterior	9.29 $\pm$ 1.86	10(9-10)	-0.717	.505
RTG	Sex	Posterior	9.90 $\pm$ 1.66	10(9-11)		
		Men	9.67 $\pm$ 1.75	9.5(9-11)	-0.380	.747
	Operation Area	Women	9.88 $\pm$ 1.67	10.5(9-11)		
		Mandible	9.74 $\pm$ 1.73	10(9-11)	-0.493	.651
		Maxilla	10.33 $\pm$ 1.15	11(9-11)		
Total	Sex	Anterior	10.6 $\pm$ 1.14	11(10-11)	-1.131	.283
		Posterior	9.59 $\pm$ 1.73	10(9-11)		
	Operation Area	Men	10.06 $\pm$ 1.39	10(9-11)	-0.816	.414
		Women	9.45 $\pm$ 1.84	10(8-11)		
		Mandible	9.60 $\pm$ 1.76	10(9-11)	-0.615	.561
		Maxilla	10.25 $\pm$ 0.96	10.5(9.5-11)		
		Anterior	9.59 $\pm$ 1.79	10(9-11)	-0.195	.845
		Posterior	9.70 $\pm$ 1.68	10(9-11)		

* $P < .05$. Mann-Whitney U test. NTG, nonrestored tooth group; RTG, restored tooth group.

Table 9. Comparison of OHIP-14 scores by sex and operative area within study groups

OHIP-14		Mean $\pm$ SD	Median (Q1-Q3)	Mean $\pm$ SD	Median(Q1-Q3)	Test Statistic	P	Effect Size
		Men		Women				
NTG	T0	5.1 $\pm$ 3.51	5.5(4-7)	14.53 $\pm$ 7.26	15(9-18)	-3.832	<.001*	1.527
	T1	11.7 $\pm$ 8.11	8(6-14)	22.71 $\pm$ 11.25	24(14-27)	-2.700	.012*	1.076
	T7	6.4 $\pm$ 6.48	4(3-5)	14.82 $\pm$ 10.05	14(7-20)	-2.366	.026*	0.943
	T30	6.2 $\pm$ 5.22	4.5(3-9)	11.76 $\pm$ 8.24	8(5-18)	-1.912	.067	-
RTG	T0	16.83 $\pm$ 8.7	14.5(13-26)	16.75 $\pm$ 11.3	16.5(8.5-19.5)	0.016	.987	-
	T1	20.33 $\pm$ 11.22	20(13-29)	21.31 $\pm$ 10.63	18(15-24)	-0.190	.851	-
	T7	7 $\pm$ 5.25	5.5(5-11)	16.63 $\pm$ 11.32	14.5(10-22.5)	-1.980	.062	-
	T30	11.5 $\pm$ 5.89	11(6-16)	13.56 $\pm$ 8.3	14.5(6.5-18.5)	-0.554	.585	-
		Anterior		Posterior				
NTG	T0	10.06 $\pm$ 7.48	6(5-15)	12.7 $\pm$ 7.99	10(7-18)	-0.865	.396	
	T1	18.18 $\pm$ 10.78	14(7-25)	19.4 $\pm$ 12.95	21.5(7-25)	-0.264	.794	
	T7	12.41 $\pm$ 10.74	12(3-20)	10.5 $\pm$ 7.99	6(4-17)	0.488	.630	
	T30	8.53 $\pm$ 8.49	5 (3-13)	11.7 $\pm$ 5.89	10.5(7-18)	-1.040	.309	
RTG	T0	14.6 $\pm$ 6.07	18(8-19)	17.41 $\pm$ 11.51	16(9-25)	-0.519	.609	
	T1	17.4 $\pm$ 7.44	19(17-22)	22.12 $\pm$ 11.24	17(14-29)	-0.876	.391	
	T7	15.4 $\pm$ 8.79	17(12-18)	13.59 $\pm$ 11.58	11(5-15)	0.322	.751	
	T30	10.2 $\pm$ 6.65	14(4-15)	13.82 $\pm$ 7.9	13(9-19)	-0.929	.364	
		Mandible		Maxilla				
NTG	T0	11.19 $\pm$ 7.74	10(6-16)	7.00 $\pm$ 0.00	7(7-7)	-	-	
	T1	19.08 $\pm$ 11.38	20.5(7-25)	7.00 $\pm$ 0.00	7(7-7)	-	-	
	T7	12 $\pm$ 9.76	11(4-20)	4.00 $\pm$ 0.00	4(4-4)	-	-	
	T30	9.73 $\pm$ 7.82	7(4-15)	9.00 $\pm$ 0.00	9(9-9)	-	-	
RTG	T0	17.79 $\pm$ 10.74	16(9-25)	10.33 $\pm$ 6.11	9(5-17)	1.157	.261	
	T1	22 $\pm$ 10.59	19(14-29)	15 $\pm$ 9.54	16(5-24)	1.074	.295	
	T7	14.68 $\pm$ 11.43	12(5-18)	9.67 $\pm$ 5.03	9(5-15)	0.737	.470	
	T30	13.37 $\pm$ 7.87	14(6-19)	10.67 $\pm$ 6.81	13(3-16)	0.560	.582	

* $P < .05$. Spearman correlations resented. NTG, non-restored tooth group; OHIP-14-PD, pain and discomfort; r, correlation coefficient; RTG, restored tooth group; T1, postoperative day 1; T7, postoperative day 7; VAS, visual analog scale.

Academy of Periodontology indicated that surgical phenotype modification, including FGG, may enhance periodontal stability and patient comfort around FDPs.³¹ The inclusion of both single crowns and short-span fixed partial dentures reflects routine clinical practice but introduces biomechanical heterogeneity. Despite this, postoperative PROMs were comparable between groups. However, the restoration material type was not stratified and may warrant further investigation.

Marginal discrepancies and excessive contours may increase PD through biological and mechanical mechanisms.²⁶⁻²⁹ In the present study, PD remained higher in restored teeth at both T0 and T30, suggesting that restoration-related effects may persist despite surgery.

Although FGG improved soft tissue stability, these differences were not fully resolved during early healing, consistent with reports describing the sustained biological influence of FDPs after mucogingival surgery.^{28-30,32}

Several studies^{7,9,19,20,43} have reported that the greatest deterioration in QoL occurred on the first postoperative day, particularly affecting pain, functional limitation, and behavioral domains. These effects were largely attributed to surgical trauma, donor-site morbidity, and the acute inflammatory response.^{8,43} The present findings, showing peak OHIP-14 scores at T1 followed by progressive improvement at T7 and T30 in both groups, supported the notion that early patient

Table 10. Relationships between VAS, analgesic consumptions, OHIP-14, and pain and discomfort scores at T1 and T7

			T1		T7	
			OHIP-14	OHIP-14-PD	OHIP-14	OHIP-14-PD
Total	VAS	r	0.268	0.168	-0.045	0.461
		P	.063	.250	.756	<.001*
	Analgesic consumption	r	0.322	0.091	0.040	0.081
		P	.024*	.533	.783	.582
NTG	VAS	r	0.089	-0.043	0.066	0.265
		P	.661	.831	.745	.182
	Analgesic consumption	r	-0.143	0.074	0.044	0.294
		P	.477	.714	.829	.136
RTG	VAS	r	0.591	0.492	-0.126	0.023
		P	.004*	.020*	.575	.918
	Analgesic consumption	r	0.466	0.162	0.054	-0.190
		P	.029*	.472	.812	.397

* $P < .05$. Spearman correlations presented. NTG, nonrestored tooth group; OHIP-14-PD, pain and discomfort; r, correlation coefficient; RTG, restored tooth group; T1, postoperative day 1; T7, postoperative day 7; VAS, visual analog scale.

Table 11. Relationships between age, graft volume, surgery duration, keratinized tissue width, and OHIP-14 scores

Total	Age	r	OHIP-14 T0	OHIP-14 T1	OHIP-14 T7	OHIP-14 T30
			0.157	0.067	0.161	0.330
NTG		P	.282	.645	.270	.021*
	Graft volume	r	−0.194	−0.131	0.109	0.089
		P	.181	.370	.456	.544
	Surgery duration	r	−0.198	0.018	−0.187	−0.110
		P	.172	.903	.198	.450
	KTW at T0	r	−0.014	−0.074	0.106	0.014
		P	.925	.612	.470	.924
	KTW at T30	r	−0.028	−0.046	0.076	−0.174
		P	.848	.752	.602	.231
	Age	r	−0.079	−0.214	0.049	0.218
		P	.695	.285	.810	.274
	Graft volume	r	−0.221	−0.120	0.121	0.114
		P	.269	.552	.548	.571
	Surgery duration	r	−0.168	0.057	−0.317	−0.166
RTG		P	.401	.779	.107	.407
	KTW at T0	r	0.047	−0.142	0.045	0.122
		P	.814	.481	.822	.544
	KTW at T30	r	−0.419	−0.156	−0.086	−0.308
		P	.030*	.437	.670	.118
	Age	r	0.244	0.394	0.435	0.294
		P	.275	.070	.043*	.184
	Graft volume	r	−0.158	−0.048	0.101	0.046
		P	.483	.832	.656	.840
	Surgery duration	r	−0.166	0.022	0.082	0.047
		P	.459	.923	.715	.837
	KTW at T0	r	0.070	0.179	0.304	0.080
		P	.756	.426	.169	.724
	KTW at T30	r	0.461	0.256	0.356	0.129
		P	.031*	.250	.104	.568

* $P < .05$. Spearman correlations presented. NTG, nonrestored tooth group; r, correlation coefficient; RTG, restored tooth group; KTW, keratinized tissue width; T0, baseline; T1, postoperative day 1; T7, postoperative day 7; T30, postoperative day 30.

Table 12. Relationships between satisfaction score and age, graft volume, surgery duration, mean VAS, mean analgesic consumption, KTW T30–T0, and OHIP-14 T30–T0

Satisfaction score		
Age	r	−0.003
	P	.982
Graft volume	r	0.057
	P	.697
Surgery duration	r	−0.029
	P	.845
Mean VAS	r	−0.231
	P	.111
Mean analgesic consumption	r	−0.551
	P	<.001*
KTW T30–T0	r	−0.086
	P	.556
OHIP-14 T30–T0	r	0.016
	P	.911

* $P < .05$. Spearman correlations presented. KTW, keratinized tissue width; r, correlation coefficient; T0, baseline; T30, postoperative day 30; VAS, visual analog scale.

experience is predominantly driven by surgical and donor-site factors rather than restorative conditions.^{7,9,10}

KTW is a key determinant of periodontal comfort and long-term tissue stability, with adequate KTW associated with improved functional tolerance and reduced inflammation.^{1,32} In restored teeth, however, increased restorative volume and altered emergence profiles may modify tissue perception despite increased KTW.^{26,29–31} Although no direct association was observed between T30 KTW and concurrent OHRQoL, the inverse correlation between T0 OHRQoL and T30 KTW

in nonrestored teeth and the positive correlation in restored teeth suggested a complex interaction between tissue phenotype, restorative environment, and patient perception.

The influence of age and sex on postoperative pain and QoL remains inconsistent in the literature. Some studies^{7,11–14} reported greater pain perception and OHRQoL impairment among women and younger individuals, possibly related to anxiety, pain expectation, and sensory sensitivity, whereas others^{15,16,19} suggested that PROMs were more strongly shaped by psychological and behavioral factors than demographic variables. Consistent with this variability, women in the NTG showed higher OHIP-14 scores during the early postoperative period, while no sex-related differences were observed in the RTG, possibly reflecting a stabilizing effect of restorative contour and volume.^{1,3,30} The absence of associations between demographic variables and satisfaction further supports the predominance of patient-centered factors in early postoperative experience.^{8,15,16}

Surgical parameters such as graft dimensions and operative time have been reported to influence postoperative morbidity after FGG.^{6,17,18,21} Previous studies^{6,18,21,44} have reported that greater graft dimensions and surgical trauma may increase analgesic consumption and reduce patient satisfaction. Pre-emptive analgesia with NSAIDs or COX-2 inhibitors has also been reported to reduce early postoperative pain and

Table 13. Linear regression analysis for satisfaction scores

Variables	β	S.E.	St. β	t	P	95% CI lower bound	95% CI upper bound
Constant	10.786	0.346		31.198	<.001*	10.090	11.481
Mean analgesic consumption	-1.192	0.288	-0.517	-4.146	<.001*	-1.770	-0.614
F:17.189 and $P<.001^*$				R^2 :0.268 and adjusted R^2 :0.252			
Excluded Variables	β		t	P			
Group (NTG)	-0.012		-0.098	.922			
Age	0.062		0.488	.628			
Sex (men)	0.149		1.197	.238			
Mandible-Maxilla (mandible)	0.021		0.158	.875			
Anterior- Posterior (posterior)	0.007		0.052	.958			
Graft volume	-0.042		-0.329	.744			
Surgery duration	-0.129		-1.016	.315			
Mean VAS	0.176		1.056	.297			
KTW T30-T0	-0.082		-0.649	.520			
OHIP-14 T30-T0	0.123		0.973	.336			

* $P<.05$. CI, confidence interval; KTW, keratinized tissue width; S.E., standard error; St. β , standardized beta coefficient.

analgesic consumption after mucogingival surgery, while biologic palatal dressings or stents may improve donor-site comfort.^{21–23} Because such interventions may alter pain perception and influence PROM interpretation, pre-emptive analgesia and palatal protection were intentionally avoided in the present study. No associations were observed between graft dimensions and PROMs. GEE analysis demonstrated significant temporal effects for VAS pain and analgesic consumption, both peaking on the first postoperative day. Regression analysis identified mean analgesic intake as the only predictor of patient satisfaction. These findings indicated that early postoperative experience after FGG appeared to be primarily driven by pain perception and its management rather than by prosthetic or graft-related factors.

Limitations of the study included age imbalance between groups, site-specific determination of GHW and GVH despite standardized GT, differences in group size, surgical site distribution and prosthetic design, absence of digital volumetric assessment, and the relatively short 30-day follow-up period that precluded medium- and long-term QoL evaluation.^{1,44,47–50} However, the consistency of PROM outcomes across groups suggested that these factors likely had limited influence on early postoperative results.

CONCLUSIONS

Based on the findings of this prospective parallel-group clinical study, the following conclusions were drawn:

1. FGG provided comparable short-term OHRQoL outcomes and high patient satisfaction in teeth with and without FDPs.
2. Although baseline OHRQoL was poorer in restored teeth, postoperative improvements occurred similarly in both groups.
3. Early postoperative experience appeared to be mainly related to pain perception, with analgesic

consumption identified as a predictor of patient satisfaction.

REFERENCES

1. Agudio G, Nieri M, Rotundo R, Cortellini P, Pini Prato G. Free gingival grafts to increase keratinized tissue: A retrospective long-term evaluation (10 to 25 years) of outcomes. *J Periodontol*. 2008;79:587–594.
2. Nabers JM. Free gingival grafts. *Periodontics*. 1966;4:243–245.
3. Hall WB, Lundergan WP. Free gingival grafts. Current indications and techniques. *Dent Clin North Am*. 1993;37:227–242.
4. Wessel JR, Tatakis DN. Patient outcomes following subepithelial connective tissue graft and free gingival graft procedures. *J Periodontol*. 2008;79:425–430.
5. Griffin TJ, Cheung WS, Zavras AI, Damoulis PD. Postoperative complications following gingival augmentation procedures. *J Periodontol*. 2006;77:2070–2079.
6. Zucchelli G, Mounssif I, Mazzotti C, et al. Does the dimension of the graft influence patient morbidity and root coverage outcomes? A randomized controlled clinical trial. *J Clin Periodontol*. 2014;41:708–716.
7. Mounssif I, Bentivoglio V, Rendón A, et al. Patient-reported outcome measures after periodontal surgery. *Clin Oral Invest*. 2023;27:7715–7724.
8. McGuire MK, Scheyer ET, Gwaltney C. Commentary: Incorporating patient-reported outcomes in periodontal clinical trials. *J Periodontol*. 2014;85:1313–1319.
9. Burkhardt R, Hämmerle CH, Lang NP. Self-reported pain perception of patients after mucosal graft harvesting in the palatal area. *J Clin Periodontol*. 2015;42:281–287.
10. Tavelli L, Ravidà A, Saleh MHA, et al. Pain perception following epithelialized gingival graft harvesting: A randomized clinical trial. *Clin Oral Invest*. 2019;23:459–468.
11. Eli I, Baht R, Kozlovsky A, Simon H. Effect of gender on acute pain prediction and memory in periodontal surgery. *Eur J Oral Sci*. 2000;108:99–103.
12. Canakci CF, Canakci V. Pain experienced by patients undergoing different periodontal therapies. *J Am Dent Assoc*. 2007;138:1563–1573.
13. Esfahani NN, Khorsand A, Salehimonfared SM. The influence of harvesting free gingival graft on self-reported pain perception: A randomized two-arm parallel clinical trial. *J Dent Sci*. 2021;16:410–416.
14. Urban T, Wenzel A. Discomfort experienced after immediate implant placement associated with three different regenerative techniques. *Clin Oral Implants Res*. 2010;21:1271–1277.
15. Klooster PW, Eber RM, Inglehart MR. Anxiety, stress, depression, and patients' responses to periodontal treatment: Periodontists' knowledge and professional behavior. *J Periodontol*. 2007;78:64–71.
16. Beaudette JR, Fritz PC, Sullivan PJ, Piccini A, Ward WE. Investigation of factors that influence pain experienced and the use of pain medication following periodontal surgery. *J Clin Periodontol*. 2018;45:578–585.
17. Fardal Ø, McCulloch CA. Impact of anxiety on pain perception associated with periodontal and implant surgery in a private practice. *J Periodontol*. 2012;83:1079–1085.
18. Wyrebeck B, Górski B, Górski R. Patient morbidity at the palatal donor site depending on gingival graft dimension. *Dent Med Probl*. 2018;55:153–159.
19. Şen D, Şengül BI, Yarkaç FU, Öncü E. Impact of platelet-rich fibrin derivatives on patient morbidity and quality of life in palatal donor sites following free gingival graft surgery: A randomized clinical trial. *Clin Oral Invest*. 2024;28:631.

20. Khalil S, Habashneh RA, Alomari S, Alzoubi M. Local application of hyaluronic acid in conjunction with free gingival graft: A randomized clinical trial. *Clin Oral Invest*. 2022;26:2165–2174.
21. Tavelli L, Asa'ad F, Acunzo R, Pagni G, Consonni D, Rasperini G. Minimizing patient morbidity following palatal gingival harvesting: A randomized controlled clinical study. *Int J Periodontics Restorative Dent*. 2018;38:e127–e134.
22. Gousias C, Alsuwaiyan Z, Fial A, Han S, Tatakis DN, Kofina V. Pre-emptive analgesia for periodontal and implant-related surgery: A systematic review and meta-analysis. *J Clin Periodontol*. 2025;52:1167–1195.
23. Basma HS, Saleh MH, Abou-Arraj RV, et al. Patient-reported outcomes of palatal donor site healing using four different wound dressing modalities following free epithelialized mucosal grafts: A four-arm randomized controlled clinical trial. *J Periodontol*. 2023;94:88–97.
24. Porto ADM, Nascimento MV, Garcia BA, de Freitas Pontes KM, Costa FWC, de Negreiros WA. Marginal adaptation of tooth-supported fixed restorations fabricated using digital scanning versus conventional impression techniques: An overview of systematic reviews. *J Prosthet Dent*. 2025;134:e1–e13.
25. Hajaj T, Rominu M, Constantin GD, Dobos M, Veja I. Influence of marginal tooth preparation designs on periodontal health and long-term stability: A narrative review. *J Clin Med*. 2025;14:7038.
26. Knoernschild KL, Campbell SD. Periodontal tissue responses after insertion of artificial crowns and fixed partial dentures. *J Prosthet Dent*. 2000;84:492–498.
27. Ercoli C, Tarnow D, Poggio CE, et al. The relationships between tooth-supported fixed dental prostheses and restorations and the periodontium. *J Prosthodont*. 2021;30:305–317.
28. Bluma E, Vidzis A, Zigurs G. The influence of fixed prostheses on periodontal health. *Stomatologija*. 2016;18:112–121.
29. Srimanepong V, Heboyan A, Zafar MS, et al. Fixed prosthetic restorations and periodontal health: A narrative review. *J Funct Biomater*. 2022;13:15.
30. Parra C, Kormas I, Afouxenides P, Foyle D. Soft tissue conditioning around teeth: A narrative review. *Dent Rep*. 2024;4:100144.
31. Lin GH, Curtis DA, Kapila Y, et al. The significance of surgically modifying soft tissue phenotype around fixed dental prostheses: An American Academy of Periodontology best evidence review. *J Periodontol*. 2020;91:339–351.
32. Barootchi S, Tavelli L, Zucchelli G, Giannobile WV, Wang HL. Gingival phenotype modification therapies on natural teeth: A network meta-analysis. *J Periodontol*. 2020;91:1386–1399.
33. Tavelli L, Barootchi S. Prevalence, incidence, risk, and protective factors for soft tissue dehiscences at implant sites in the absence of disease: An AO/AAP systematic review and meta-regression analysis. *J Periodontol*. 2025;96:562–586.
34. Shao Y-Q, Xiong Z-Y, Liu D-X, et al. Clinical observations of soft tissue dimensions around teeth and implants after free gingival graft. *Int Dent J*. 2025;75:1311–1318.
35. Schulz KF, Altman DG, Moher D, Group C. CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials. *J Clin Epidemiol*. 2010;63:834–840.
36. Cairo F, Nieri M, Cincinelli S, Mervelt J, Pagliaro U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: An explorative and reliability study. *J Clin Periodontol*. 2011;38:661–666.
37. Bandourah AA, Atef M, D'Souza J, et al. Periodontal considerations for fixed prosthodontics: A literature review. *J Int Dent Med Res*. 2025;18:934–944.
38. Akcan SK, Ayyildiz BG. The comparison of patient-related outcome measures after free gingival graft surgery between teeth and implants: A prospective, parallel-designed, clinical study. *Int J Oral Maxillofac Implants*. 2025;40:670–682.
39. Karakış Akcan S, Güler B, Hatipoğlu H. The effect of different gingival phenotypes on dimensional stability of free gingival graft: A comparative 6-month clinical study. *J Periodontol*. 2019;90:709–717.
40. Özcelik O, Haytac MC, Seydaoglu G. Immediate post-operative effects of different periodontal treatment modalities on oral health-related quality of life: A randomized clinical trial. *J Clin Periodontol*. 2007;34:788–796.
41. Mumcu G, Inanc N, Ergun T, et al. Oral health related quality of life is affected by disease activity in Behçet's disease. *Oral Dis*. 2006;12:145–151.
42. Fischer KR, Lindner I, Fickl S. Implant treatment in periodontally compromised subjects—quality of life and patient satisfaction. *Clin Oral Invest*. 2016;20:697–702.
43. Tonetti MS, Cortellini P, Pellegrini G, et al. Xenogenic collagen matrix or autologous connective tissue graft as adjunct to coronally advanced flaps for coverage of multiple adjacent gingival recession: Randomized trial assessing non-inferiority in root coverage and superiority in oral health-related quality of life. *J Clin Periodontol*. 2018;45:78–88.
44. Zucchelli G, Mele M, Stefanini M, et al. Patient morbidity and root coverage outcome after subepithelial connective tissue and de-epithelialized grafts: A comparative randomized-controlled clinical trial. *J Clin Periodontol*. 2010;37:728–738.
45. Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G* power 3.1: Tests for correlation and regression analyses. *Behav Res Methods*. 2009;41:1149–1160.
46. Cohen J. Statistical Power Analysis for the Behavioral Sciences. Lawrence Erlbaum Associates, Inc; 1988.
47. Mei CC, Lee FY, Yeh HC. Assessment of pain perception following periodontal and implant surgeries. *J Clin Periodontol*. 2016;43:1151–1159.
48. Kim Y, Oh TJ, Misch CE, Wang HL. Occlusal considerations in implant therapy: Clinical guidelines with biomechanical rationale. *Clin Oral Implants Res*. 2005;16:26–35.
49. Sánchez-Siles M, Torres-Diez LC, Camacho-Alonso F, Salazar-Sánchez N, Ballester Ferrandis JF. High volume local anesthesia as a postoperative factor of pain and swelling in dental implants. *Clin Implant Dent Relat Res*. 2014;16:429–434.
50. Parvini P, Müller KM, Cafferata EA, Schwarz F, Obreja K. Immediate versus delayed implant placement in the esthetic zone: A prospective 3d volumetric assessment of peri-implant tissue stability. *Int J Implant Dent*. 2022;8:58.

Corresponding author:

Asst Prof Serap Karakis Akcan
Istanbul Gelisim University Dental Hospital
Petrol Ofisi Caddesi, No: 3, Cihangir Mahallesi
Avcılar, Istanbul 34310
TURKEY
Email: skarakis@gelisim.edu.tr

CRediT authorship contribution statement

Serap Karakis Akcan: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Software, Supervision, Validation, Visualization, Writing – Original Draft, Writing – Review and Editing.
Busra Terzioğlu: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – Original Draft, Writing – Review and Editing.
Bereste Güler Ayyildiz: Conceptualization, Data curation, Methodology, Resources, Supervision, Writing – Original Draft Preparation, Writing – Review and Editing.

Copyright © 2026 by the Editorial Council of *The Journal of Prosthetic Dentistry*. All rights are reserved, including those for text and data mining, AI training, and similar technologies.
<https://doi.org/10.1016/j.prosdent.2026.07.021>