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Preoperative information-seeking behavior and perioperative experiences in patients undergoing periodontal mucogingival surgery: a single-center cross-sectional survey

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Objectives: To characterize patients' preoperative information-seeking behaviors and procedure-specific understanding regarding periodontal mucogingival surgery for gingival recession, and identify factors associated with obtaining information from professional healthcare sources, thereby informing preoperative health education by medical students and junior clinicians.
Methods: In this single-center, cross-sectional questionnaire survey conducted at the 6-month postoperative follow-up at a tertiary dental hospital in China, preoperative anxiety and information-seeking behaviors were assessed retrospectively. Hospital records of 2,876 patients who underwent periodontal surgery between July 2022 and December 2025 were screened. Of the 72 patients who underwent mucogingival surgery for Cairo RT1 recession, 66 returned valid questionnaires and were included in the analysis. Each factor was assessed separately in crude and age- and sex-adjusted exploratory models, with Firth sensitivity analyses.
Results: Overall, 93.94% of patients reported learning about the surgery before treatment, and 45.45% selected professional medical staff as their information source. Procedure-specific understanding was favorable (96.97% understood the surgical procedure; 98.48% knew initial periodontal therapy was required). Mild preoperative anxiety was reported by 65.15% of patients. The crude education trend was not statistically significant (OR = 1.57, 95% CI: 0.85–2.89, $p = 0.151$), whereas a positive trend emerged after age and sex adjustment (OR = 2.50, 95% CI: 1.11–5.63, $p = 0.026$), with a similar Firth sensitivity estimate (OR = 2.24, 95% CI: 1.11–5.20, $p = 0.022$). Patients reported that psychological burden, systemic health status, and surgical cost influenced their decisions. Preoperative anxiety was positively associated with postoperative reactions and the influence of psychological burden on decision-making, and postoperative reactions were associated with the reported influence on future surgery decisions.
Conclusion: Education level showed an exploratory association with professional information seeking among patients who had undergone mucogingival surgery. Statistical associations were also observed among recalled preoperative anxiety, postoperative reactions, and reported decision-making influences. Their relevance to preoperative communication requires prospective evaluation.

KEYWORDS
gingival recession, health knowledge attitudes practice, surveys and questionnaires, dental health education, health-seeking behavior

Introduction

Gingival recession (GR) refers to the apical displacement of the gingival margin from the cementoenamel junction, exposing the root surface. It is one of the most common mucogingival conditions in clinical dentistry. GR may lead to dentin hypersensitivity, root caries, non-carious cervical lesions, difficulty in plaque control, and aesthetic concerns in the anterior region, thereby affecting oral health and quality of life (1–3). A recent systematic review and meta-analysis including 22 observational studies reported that the global prevalence of GR was 81.1% (95% CI: 73.9–86.7) using a threshold of ≥1 mm, and 48.4 and 16.2% using thresholds of ≥3 mm and ≥5 mm, respectively (4). With improved living standards and rising aesthetic demands, more patients are seeking dental care for GR. Managing aesthetic and functional problems related to GR has therefore become a common clinical need in periodontology.

Mucogingival surgery is a major treatment approach for GR, and root coverage procedures are key techniques for managing this condition (5). Although mucogingival surgical techniques have become increasingly mature, evidence regarding how patients undergoing these procedures obtain preoperative information and understand surgery-related details remains limited. A cross-sectional study of 205 participants showed that among 147 patients clinically diagnosed with GR, 38.8% were unaware of their recession condition, and lack of condition awareness was associated with sex, education level, and oral hygiene habits (6). However, systematic surveys of preoperative information-seeking patterns and procedure-specific understanding among patients undergoing periodontal mucogingival surgery are scarce. Understanding the necessity of surgery, procedures, risks, costs, and expected outcomes is relevant to informed treatment decisions (7, 8). In addition, the relationships among preoperative anxiety, postoperative reactions, psychological burden, and the reported influence on future surgery decisions require further investigation.

Therefore, this study conducted a postoperative questionnaire survey among patients with GR who underwent periodontal mucogingival surgery. The study aimed to characterize preoperative information-seeking behaviors and procedure-specific understanding regarding periodontal mucogingival surgery, analyze factors associated with obtaining information from professional healthcare sources, and examine the relationships among preoperative anxiety, postoperative reactions, psychological burden, and the reported influence on future surgery decisions. The findings may identify topics for preoperative communication and health education delivered by medical students and junior clinicians; effects on surgical acceptance and treatment outcomes were not evaluated.

Methods

Study design and data collection

This study was approved by the Ethics Committee of the Hospital of Stomatology, Guangzhou Medical University (approval number: LCYJ2023055). The approved protocol covered questionnaire surveys of patients who had undergone surgery from July 2022 onward. A total of 2,876 patients who underwent periodontal surgery at the Hospital of Stomatology, Guangzhou Medical University between July 2022 and December 2025 were screened. Among them, 72 patients underwent periodontal mucogingival surgery for Cairo RT1 GR. The original clinical records used Miller Class I/II to classify gingival recession. During manuscript revision, one researcher retrospectively reviewed the original periodontal examination charts and preoperative clinical records to verify the classification according to Cairo RT1 criteria, particularly the absence of interproximal clinical attachment loss. This was a cross-sectional questionnaire survey conducted at the scheduled 6-month postoperative follow-up, using the hospital's electronic medical record system and postoperative follow-up registry to identify eligible patients. Recruitment covered all eligible patients identified within this surgical time window, and the final analytic sample was determined after questionnaire quality screening. No *a priori* sample-size estimation or statistical power calculation was performed. Preoperative anxiety and information-seeking behaviors were assessed retrospectively. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies (9) and the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (10). The completed checklists are provided in Supplementary materials S1, S2.

The inclusion criteria were as follows: (1) clinical diagnosis of Cairo RT1 GR; (2) receipt of periodontal mucogingival surgery; (3) age ≥18 years; (4) ability to complete the questionnaire independently; and (5) provision of electronic informed consent to participate in the questionnaire survey.

The exclusion criteria were as follows: (1) severe systemic disease, including uncontrolled hypertension, diabetes, or severe cardiovascular or cerebrovascular disease; (2) psychiatric disease or cognitive impairment; (3) pregnancy or lactation; and (4) a previous history of periodontal mucogingival surgery (patients with a history of non-mucogingival periodontal surgery were eligible).

A senior nurse and medical students in the research team conducted the survey after receiving standardized training on the study purpose and participant eligibility criteria. Investigators first approached eligible patients in the outpatient clinic and recruited them through Wenjuanxing questionnaire links sent privately via WeChat; participation was voluntary, with no incentives or public advertising. At their scheduled 6-month postoperative follow-up, patients accessed the consent page through the link, read information about the study purpose and expected completion time, and could proceed to the questionnaire only after actively providing electronic informed consent. Completed responses were collected automatically by the platform.

Registration was required to access the questionnaire. Both IP-address and WeChat-account restrictions limited each to one submission throughout the survey period. Wenjuanxing automatically set and read browser cookies to assign a client identifier and recognize repeat attempts from the same device and browser as already completed. The cookie validity period was not documented. Platform

logs were also screened after consent and data collection; no duplicate records were identified. Only investigators could access the original identifiable data. All items required a response before submission to prevent unanswered items; "preferred not to answer" responses were treated as missing values for the corresponding variable. Only submitted questionnaires were analyzed; partially completed questionnaires were not included. Questionnaires were considered invalid if the completion time was ≤120 s, information was incorrect, or responses were highly repetitive. A similar 120-s exclusion threshold has been used in an online health questionnaire survey (11). The cutoff used here was a study-specific screening threshold and was not validated for this questionnaire.

All 72 invited patients visited the consent page, agreed to participate, and submitted a questionnaire. The response rate among invited patients, CHERRIES participation rate (consenting patients/consent-page visitors), and completion rate (submitted questionnaires/consenting patients) were each 100% (72/72). Six questionnaires were excluded following quality screening, leaving 66 for analysis (valid questionnaire rate, 91.7%; 66/72 submitted questionnaires). Individual records of the six excluded respondents were not retained; their characteristics and exclusion counts by reason could therefore not be reported. During data collection and analysis, questionnaire data were independently checked by two researchers before statistical analysis. The sample selection process is shown in Figure 1. During manuscript revision, the dataset was rechecked against the original records to verify data accuracy. This process led to minor corrections in the counts for preoperative information sources, first periodontal surgery, and missing income data, along with the corresponding demographic distributions. All results presented in the revised manuscript and tables reflect the verified data.

Clinical characteristics were also collected to describe the sample, including treated teeth, recession depth, keratinized tissue width, surgical technique, palatal graft harvesting, graft dimensions, postoperative medication, and root coverage at 6 months. For multiple adjacent treated teeth, the minimum recession depth, keratinized tissue width, and root coverage were recorded for each patient.

Questionnaire

The questionnaire was developed with reference to the WHO oral health report, the Fourth National Oral Health Survey of China, and relevant domestic and international literature (12–15). After the initial questionnaire was drafted, six experts from dentistry and nursing reviewed the items for relevance, clarity, and appropriateness, and the questionnaire was revised accordingly. A pilot survey was then conducted among 10 conveniently selected patients to assess whether each item was easy to understand and to reduce ambiguity. The usability and technical functionality of the electronic questionnaire were tested before formal administration. The questionnaire was a survey instrument that collected item-level information across distinct domains, rather than a

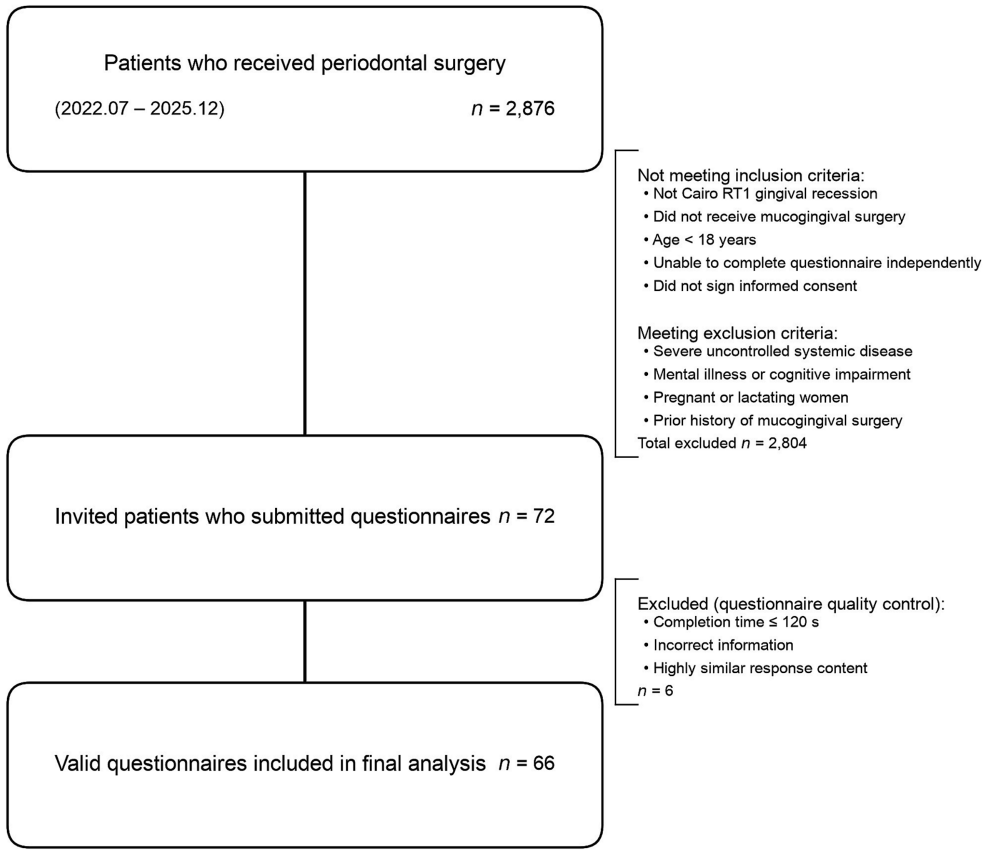

FIGURE 1
Flowchart of sample selection. Among 2,876 patients who received periodontal surgery, 72 eligible patients were identified according to the inclusion and exclusion criteria and invited to complete the questionnaire. All 72 invited patients submitted questionnaires (response rate, 100%). Six questionnaires were excluded after quality screening, and 66 were included in the final analysis (valid questionnaire rate, 91.7% of submitted questionnaires).

psychometric scale measuring a single construct. Therefore, no total score was calculated, internal consistency (Cronbach's alpha) was not applicable, and each item was analyzed individually.

The questionnaire included three sections: (1) basic patient information, including sex, age, education level, marital status, income level, medical insurance type, and history of dental visits; (2) preoperative information seeking, procedure-specific understanding, and perioperative experiences, including information sources, understanding of surgical procedures, preoperative anxiety, doctor-patient communication, informed consent, knowledge of initial periodontal therapy, and postoperative reactions; and (3) patient-reported influences on surgical decision-making, including surgery-related understanding, cost, psychological burden, systemic health status, and subsequent treatment options. The survey comprised four pages: electronic informed consent on page 1, basic information (items 1–9) on page 2, preoperative information and perioperative experiences (items 10–15) on page 3, and decision-making influences (items 16–20) on page 4. The 20 single-choice items followed the fixed order shown in Supplementary material S3. No adaptive questioning was used. Respondents could review and modify their answers before submission. The preoperative information-source item required patients to select one of four responses: Internet, people around me, attending doctor or nurse, or no information. The English version of the questionnaire is provided in Supplementary material S3.

Patients selected the preset response that best described their recalled preoperative anxiety and postoperative reactions; investigators did not assign grades. Anxiety categories were no anxiety; mild anxiety (nervousness, uneasiness, unexplained worry, or panic); moderate anxiety (persistent nervousness and uneasiness, worry, palpitations, or heart pounding); and severe anxiety (persistent nervousness and uneasiness with worry and physical symptoms such as headache, dizziness, abdominal pain, or diarrhea). Postoperative reaction categories were no special discomfort; mild symptoms (slight bleeding, pain, or swelling); and obvious discomfort (obvious pain or swelling requiring oral analgesics for relief). These were questionnaire response descriptions, not validated diagnostic or clinical severity criteria.

Statistical analysis

SPSS 25.0 was used for statistical analysis. Categorical data were expressed as frequencies and percentages, *n* (%). Continuous clinical variables were summarized as medians and ranges. The dependent variable was professional information seeking, defined as selecting the attending doctor or nurse in the preoperative information-source item versus any other response.

Age, education, income, and time since first dental treatment retained their original questionnaire categories without merging. These categories were set during questionnaire development with reference to previous literature, rather than selected from the observed results. Category boundaries are provided in Table 1 and Supplementary material S3. Following the use of ordered education scores for trend estimation (16), education (below junior college, junior college, bachelor's degree, and postgraduate), income, and time since first dental treatment were scored in ascending original-category order as 0–3, 0–4, and 0–3, respectively. Trend ORs correspond to a one-point score increase, representing one original category. The scores indicate category order rather than equally spaced educational years, income amounts, or treatment intervals, and assume equal log-odds increments between adjacent categories. Age, marital status, and insurance were entered as categorical variables. "Preferred not to answer" responses were treated as missing values and excluded only from the primary income ($n = 14$, 21.2%) or marital-status ($n = 1$) model; no values were imputed. An additional income sensitivity analysis retained all 66 patients, entering the five original income brackets and "preferred not to answer" as six nominal categories, with <150,000 CNY as reference. Firth logistic regression adjusted for age and sex was used because the highest income bracket had no professional-source responses.

Crude logistic regressions were fitted for all nine demographic, socioeconomic, and dental-history factors. Each factor other than age and sex was then assessed in a separate model adjusting for age (18–44, 45–59, >60 years) and sex. Age and sex were mutually adjusted in a common model. This limited adjustment was applied consistently to all factors, without selection by univariable *p* values (17). Age and sex were chosen as basic demographic adjustment variables because information-seeking patterns can differ by age and sex (18). The target factors were not mutually adjusted, so the estimates describe basic adjusted associations. Odds ratios (ORs), 95% confidence intervals (CIs), and Wald *p*-values were reported where maximum-likelihood estimates were finite; overall factor tests used likelihood-ratio tests. Firth penalized logistic regression was applied to every adjusted model as a sensitivity analysis, using profile penalized-likelihood CIs and penalized likelihood-ratio tests (19). For marital status and insurance, Firth estimates were the available finite estimates because sparse categories caused separation in ordinary regression. Events per predictor parameter (EPV) were calculated as the number of outcome events divided by the number of predictor parameters, excluding the intercept and counting categorical indicators separately. Complete results and model sample sizes are provided in Supplementary material S4.

To further explore associations between perioperative experiences and surgical decision-making, three relationships were assessed: preoperative anxiety with postoperative reactions, preoperative anxiety with the influence of psychological burden on decision-making, and postoperative reactions with the reported influence on future surgery decisions. Linear-by-linear association tests assessed trend, and Goodman–Kruskal gamma (γ) with 95% CIs described direction and strength. Categories were ordered from none to greater anxiety, postoperative symptoms, or influence on future surgery; psychological burden was coded as no or yes. 95% CIs for γ were obtained from 10,000 patient-level bootstrap samples. All regression and ordinal association analyses were exploratory and hypothesis generating. *p*-values were unadjusted for multiple comparisons and were interpreted descriptively. Surgical technique and the presence of a palatal donor site were not included as covariates because both were identical across all patients. No subgroup or interaction analyses, sampling weights, or propensity-score corrections were used; no complex sampling design was used.

Results

Preoperative information seeking, procedure-specific understanding, and decision-making factors

The 66 patients had 98 treated teeth. All underwent the envelope technique with a palatal connective tissue graft (CTG) harvested

TABLE 1 Original-category distributions of factors associated with professional information seeking.

Variable	Original category	Total, *n* (%)	Professional source, *n* (%)	Other source, *n* (%)
Sex	Female	43 (65.15)	22 (51.16)	21 (48.84)
	Male	23 (34.85)	8 (34.78)	15 (65.22)
Age	18–44 years	39 (59.09)	17 (43.59)	22 (56.41)
	45–59 years	19 (28.79)	7 (36.84)	12 (63.16)
	>60 years	8 (12.12)	6 (75.00)	2 (25.00)
Education	Below junior college	7 (10.61)	2 (28.57)	5 (71.43)
	Junior college	9 (13.64)	4 (44.44)	5 (55.56)
	Bachelor's degree	38 (57.58)	16 (42.11)	22 (57.89)
	Postgraduate	12 (18.18)	8 (66.67)	4 (33.33)
Marital status	Unmarried	14 (21.21)	7 (50.00)	7 (50.00)
	Married	49 (74.24)	20 (40.82)	29 (59.18)
	Widowed	1 (1.52)	1 (100.00)	0 (0.00)
	Divorced	1 (1.52)	1 (100.00)	0 (0.00)
	Preferred not to answer	1 (1.52)	1 (100.00)	0 (0.00)
Annual household income	<150,000 CNY	17 (25.76)	8 (47.06)	9 (52.94)
	150,000–300,000 CNY	19 (28.79)	10 (52.63)	9 (47.37)
	300,000–500,000 CNY	9 (13.64)	4 (44.44)	5 (55.56)
	500,000–1,000,000 CNY	6 (9.09)	3 (50.00)	3 (50.00)
	>1,000,000 CNY	1 (1.52)	0 (0.00)	1 (100.00)
	Preferred not to answer	14 (21.21)	5 (35.71)	9 (64.29)
Medical insurance	Self-paid	17 (25.76)	5 (29.41)	12 (70.59)
	Employee insurance	33 (50.00)	16 (48.48)	17 (51.52)
	Publicly funded	13 (19.70)	7 (53.85)	6 (46.15)
	Employer reimbursement	1 (1.52)	0 (0.00)	1 (100.00)
	Commercial insurance	2 (3.03)	2 (100.00)	0 (0.00)
Time since first dental treatment	<1 year	9 (13.64)	4 (44.44)	5 (55.56)
	1–5 years	38 (57.58)	20 (52.63)	18 (47.37)
	5–10 years	10 (15.15)	3 (30.00)	7 (70.00)
	>10 years	9 (13.64)	3 (33.33)	6 (66.67)
Regular dental checkups	Yes	50 (75.76)	24 (48.00)	26 (52.00)
	No	16 (24.24)	6 (37.50)	10 (62.50)
First periodontal surgery	Yes	45 (68.18)	22 (48.89)	23 (51.11)
	No	21 (31.82)	8 (38.10)	13 (61.90)

N = 66. Percentages in the Total column use all 66 patients as the denominator; percentages in the two information-source columns use the number of patients in each original category. Professional source indicates selecting the attending doctor or nurse in the single-choice item; Other source includes all remaining responses. The age category <18 years had no observations and is omitted. Original income and dental-treatment-history intervals are retained as given in the questionnaire, without inferring exact allocation of boundary values. Preferred not to answer is shown separately as missing data for the corresponding variable and excluded only from that variable's primary regression analysis. Income was missing for 14 patients (21.2%); a sensitivity analysis retaining these patients as a separate category is provided in Supplementary material S4: Table S4. Crude, adjusted, and Firth results are provided in Supplementary material S4. CNY, Chinese yuan.

using the single-incision technique. Median recession depth was 3 mm (range, 2–5 mm), median keratinized tissue width was 2 mm (range, 1–3 mm), and median root coverage at 6 months was 83.3% (range, 66.7–100%). Clinical characteristics are summarized in Table 2.

Overall, 93.94% of patients reported learning about the surgery before treatment, and 45.45% selected professional medical staff (attending doctor or nurse) as their information source. Procedure-specific understanding was generally favorable: 96.97% of patients partly or fully understood the mucogingival surgical procedure, 98.48% knew that initial periodontal therapy was required before surgery, and 80.30% recalled signing an informed consent form. Mild preoperative anxiety was reported by 65.15% of patients. Regarding factors influencing surgical decision-making, 83.33% of patients reported that their understanding of surgery influenced their decision, 71.21% considered systemic health status, 57.58% were affected by psychological burden, and 46.97% considered surgical cost. Additional results are shown in Table 3.

Crude and adjusted associations with professional information seeking

Women accounted for 65.15% of the sample, patients aged 18–44 years for 59.09%, patients with bachelor's or postgraduate education for 75.76%, patients with regular dental checkups for 75.76%, and patients reporting their first periodontal surgery for 68.18%. Original-category distributions are shown in Table 1. The crude education trend estimate was OR = 1.57 (95% CI: 0.85–2.89, $p = 0.151$). Other factors with finite ordinary regression estimates had crude overall p-values >0.05; marital status and insurance had sparse categories causing separation.

After age and sex adjustment, the education trend estimate was OR = 2.50 (95% CI: 1.11–5.63, $p = 0.026$). The Firth sensitivity estimate was OR = 2.24 (95% CI: 1.11–5.20, $p = 0.022$). The education model included 30 events and four predictor parameters, giving EPV = 7.50. Adjusted models for other factors had overall p-values >0.05, including marital status (Firth $p = 0.789$) and insurance (Firth $p = 0.317$). Income was missing for 14 of 66 patients (21.2%). In the sensitivity analysis retaining these patients as a separate category, the overall income test yielded $p = 0.643$; the missing-income category had adjusted OR = 0.38 (95% CI: 0.06–1.86, $p = 0.239$) relative to <150,000 CNY (Supplementary material S4: Table S4). Crude and adjusted estimates for the five trend or binary target factors are shown in Figure 2; all estimates, sensitivity analyses, and EPV values are reported in Supplementary material S4.

TABLE 2 Clinical characteristics of patients undergoing mucogingival surgery.

Characteristic	Value
Treated teeth, total	98
Number of treated teeth per patient, median (range)	1 (1–4)
Single treated tooth, *n* (%)	46 (69.70)
Multiple treated teeth, *n* (%)	20 (30.30)
Maxillary surgery, *n* (%)	36 (54.55)
Mandibular surgery, *n* (%)	30 (45.45)
Recession depth, mm, median (range)	3 (2–5)
Keratinized tissue width, mm, median (range)	2 (1–3)
Envelope technique with palatal CTG, *n* (%)	66 (100.00)
Palatal graft harvested using the single-incision technique, *n* (%)	66 (100.00)
Graft length, mm, median (range)	12 (8–27)
Graft width, mm, median (range)	6 (4–8)
Graft thickness, mm, median (range)	1.2 (1.0–1.5)
Postoperative medication regimen A, *n* (%)	63 (95.45)
Postoperative medication regimen B, *n* (%)	3 (4.55)
Root coverage at 6 months, %, median (range)	83.3 (66.7–100)

$n = 66$; percentages use patients as the denominator. Each patient underwent surgery in one arch. For multiple adjacent treated teeth, recession depth, keratinized tissue width, and root coverage represent the minimum value among the treated teeth. Graft dimensions describe the harvested tissue, not the palatal wound area. Regimen A: amoxicillin 0.5 g orally three times daily for 5 days; regimen B: clindamycin 0.3 g orally three times daily for 5 days. Clindamycin was prescribed to three patients because of a reported history of penicillin allergy. Both regimens included ibuprofen 0.3 g orally as needed and 0.12% chlorhexidine mouth rinse for 1 min twice daily for 2 weeks. CTG, connective tissue graft.

Associations among perioperative experiences and reported decision-making influences

Preoperative anxiety level was positively associated with postoperative reactions ($\gamma = 0.611$, 95% CI: 0.213–0.865, $p = 0.009$). In the no-anxiety group, 60.0% of patients reported no specific postoperative discomfort. In the mild-anxiety group, 67.4% reported mild symptoms. All patients in the moderate-anxiety group reported mild symptoms. Preoperative anxiety was also positively associated with the influence of psychological burden on decision-making ($\gamma = 0.783$, 95% CI: 0.477–0.956, $p < 0.001$). Only 25.0% of patients in the no-anxiety group reported that psychological burden affected their surgical choice. In contrast, this proportion increased to 69.8% in the mild-anxiety group and 100.0% in the moderate-anxiety group. Postoperative reactions were positively associated with the reported influence on future surgery decisions ($\gamma = 0.740$, 95% CI: 0.436–0.945, $p < 0.001$). In the group without postoperative discomfort, 76.0% reported that the experience would not affect future surgical decisions. In the mild-symptom group, 70.0% reported a mild influence. The patient with obvious discomfort ($n = 1$) reported a mild influence. Details are shown in Figure 3.

Discussion

This questionnaire survey included 66 patients with GR who underwent mucogingival surgery and systematically characterized their preoperative information-seeking patterns, procedure-specific understanding, and perioperative experiences. Education level showed a positive trend with professional information seeking after age and sex adjustment, and associations among preoperative anxiety, postoperative reactions, psychological burden, and the reported influence on future surgery decisions were observed. These findings complement previous evidence on patients' recognition of GR (6) by focusing specifically on patients who had actually undergone mucogingival surgery and jointly assessing preoperative information acquisition and perioperative experiences.

Among the 66 respondents, 93.94% reported learning about the surgery before treatment, and 45.45% selected the attending doctor or nurse as their information source. The prevalence of preoperative anxiety was 69.70%, mainly mild anxiety. In terms of procedure-specific understanding, the overall level was favorable: 96.97% of patients partly or fully understood the mucogingival surgical procedure, and 98.48% knew the necessity of initial periodontal therapy before surgery, these descriptive measures reflect patients' procedural comprehension and knowledge, which may be related to routine preoperative explanations and targeted oral health education in tertiary specialty clinics (20, 21). However, 12.12% of patients still did not clearly understand the content of doctor-patient communication (Table 3), suggesting that current preoperative health education may lack individualized design. Jönsson et al. found that individually tailored oral health education had greater clinical value than standardized education (22), supporting the need to optimize preoperative communication.

After clarifying the information-seeking profile, key factors associated with professional information seeking were further analyzed. The crude education trend did not reach $P < 0.05$ (OR = 1.57, 95% CI: 0.85–2.89, $p = 0.151$), whereas the age- and sex-adjusted trend was positive

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TABLE 3 Preoperative information seeking, procedure-specific understanding, perioperative experiences, and decision-making factors.

Item	Category	*n* (%)
Preoperative surgery-related information source	Attending doctor or nurse	30 (45.45)
	Online platforms	21 (31.82)
	People around me	11 (16.67)
	Did not learn about the surgery	4 (6.06)
Understanding of the mucogingival surgical procedure	Fully understood	25 (37.88)
	Partly understood	39 (59.09)
	Did not understand	2 (3.03)
Knowledge of the necessity of initial periodontal therapy before surgery	Yes	65 (98.48)
	No	1 (1.52)
Preoperative anxiety level	No anxiety	20 (30.30)
	Mild anxiety	43 (65.15)
	Moderate anxiety	3 (4.55)
	Severe anxiety	0 (0.00)
Preoperative communication	Informed and fully understood	58 (87.88)
	Informed but not fully understood	8 (12.12)
	Completely uninformed	0 (0.00)
Signing of preoperative informed consent	Signed	53 (80.30)
	Do not remember	12 (18.18)
	Did not sign	1 (1.52)
Postoperative reaction	No special discomfort	25 (37.88)
	Mild symptoms	40 (60.61)
	Obvious discomfort	1 (1.52)
Factors influencing surgical decision-making		
Self-reported influence of surgery-related understanding	Yes	55 (83.33)
	No	11 (16.67)
Surgical cost	Yes	31 (46.97)
	No	35 (53.03)
Psychological burden	Yes	38 (57.58)
	No	28 (42.42)
Systemic health status	Yes	47 (71.21)
	No	19 (28.79)
Influence on future treatment choices	No influence	29 (43.94)
	Mild influence	34 (51.52)
	Moderate influence	3 (4.55)

$N = 66$. Data are presented as n (%). Anxiety and postoperative reactions were selected by patients using the preset descriptions in Supplementary material S3, items 11 and 15; grades were not assigned by investigators. Decision-making responses describe perceived influences among patients who had undergone surgery. Future-treatment responses describe stated intentions, not observed decisions.

(OR = 2.50, 95% CI: 1.11–5.63, $p = 0.026$; Figure 2). The Firth sensitivity analysis gave a similar direction (OR = 2.24, 95% CI: 1.11–5.20, $p = 0.022$). This increase in the education-related OR after adjustment may partly reflect negative confounding by age. Patients aged >60 years had a higher proportion of below-bachelor's education (62.5%) than those aged 18–44 years (12.8%), yet were more likely to select professional information sources (75.0% vs. 43.6%), potentially attenuating the crude association. Previous studies have shown that educational attainment is closely related to patients' ability to access and understand health information and may influence patterns of dental care utilization and information seeking (23–25). In particular, recent evidence suggests that individuals with higher health literacy may be more likely to rely on reliable dental information sources, including dental professionals, although this association has not been consistently observed across studies (25). These findings may provide one possible explanation for the association observed in this study. The other factors had overall p values >0.05 in the basic adjusted analyses. The commercial-insurance contrast was based on only two patients and had a very wide CI. The models did not mutually adjust the target factors, and the education estimate represents a trend across assigned category scores rather than an independent or causal effect. This small sample cannot exclude associations with the other characteristics.

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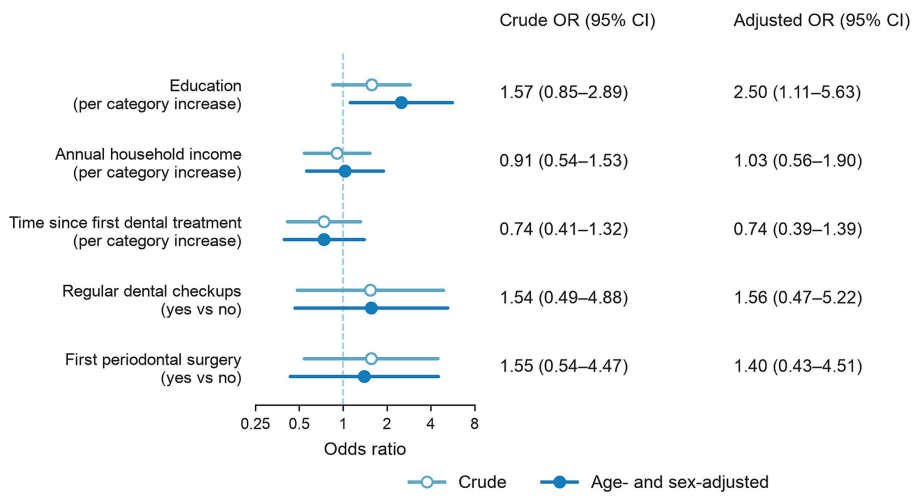

FIGURE 2
Crude and adjusted associations with professional information seeking. Open and filled circles indicate crude and adjusted *ORs*, respectively; horizontal lines indicate 95% *CIs*, and the dashed line indicates *OR* = 1. Each adjusted model includes one target factor, original age categories, and sex; target factors are not mutually adjusted. *ORs* for education, income, and time since first dental treatment represent a one-category increase; the other two comparisons are yes versus no. Income models include 52 patients; the other models include 66. Complete results for marital status, insurance, and Firth sensitivity analyses are provided in Supplementary material S4.

In addition to socioeconomic factors, psychological, systemic, and financial factors should not be overlooked in surgical decision-making. In this survey, 57.58% of patients reported that psychological burden affected their surgical choice (Figure 3B), and 71.21% were concerned about the influence of systemic health status on surgery. Surgical cost also influenced surgical decisions in 46.97% of patients (Table 3), consistent with prior evidence that financial considerations represent an important practical barrier in elective periodontal plastic surgery (7, 8). Wright et al. reported that patient behavioral factors, including anxiety and personality traits, can significantly affect dental implant treatment outcomes (26), which is consistent with the finding that psychological burden affected surgical choice in this study. Dental anxiety and dental phobia often begin in childhood. They may persist into adulthood, leading to treatment-related psychological burden, avoidance of dental care, and subsequent deterioration in oral health and quality of life (27–29). Cognitive behavioral therapy has been shown to effectively reduce anxiety and psychological burden before dental treatment (30, 31). In addition, although mucogingival surgery is a local procedure, systemic disease control remains clinically relevant in periodontal plastic surgery (32). In particular, diabetes and poor glycemic control can impair oral soft-tissue wound healing and compromise surgical outcomes (33). Patients' concerns regarding their systemic health status therefore reflect legitimate considerations about wound healing and surgical prognosis. These reported concerns identify topics for preoperative discussion; this survey did not evaluate the effects of psychological assessment, counseling, or systemic condition evaluation.

Patient-reported outcome measures (PROMs) provide a clinical context for these postoperative reactions. Cairo et al.'s systematic review of single-recession root coverage assessed patient-perceived aesthetics, satisfaction, and postoperative pain or discomfort; heterogeneous morbidity measures prevented quantitative pooling (34). In a multicenter randomized trial of multiple-recession root coverage, Tonetti et al. found that a xenogeneic collagen matrix shortened recovery and analgesic use compared with CTG, although CTG achieved better root coverage (35). These findings support discussing expected discomfort and recovery alongside root coverage benefits before surgery. All patients in the present survey received palatal CTG; the retrospective postoperative-reaction item describes recalled symptoms rather than a validated PROM and cannot distinguish donor-site from recipient-site morbidity or compare graft materials.

The exploratory association analysis showed relationships among preoperative anxiety, postoperative reactions, psychological burden, and the reported influence on future surgery decisions. Patients with higher preoperative anxiety tended to report more obvious postoperative discomfort (Figure 3A, $P = 0.009$). Similar tendencies have been described in other fields of oral surgery, for example, a prospective cohort study of 213 patients undergoing third molar extraction that measured preoperative dental anxiety observed an association with postoperative symptom severity (36). Anxiety level was also associated with the reported influence of psychological burden on surgical choice (Figure 3B, $P < 0.001$). Only a minority of patients without anxiety reported that psychological burden affected surgical choice, whereas all patients with moderate anxiety reported such an influence. Classic research on dental anxiety describes this process as a vicious cycle: anxiety triggers avoidance of treatment, negative dental experiences reinforce anxious expectations, and psychological resistance to subsequent interventions increases, leaving patients with a heavier psychological burden when facing another surgical decision (30, 37). Postoperative reactions were associated with the reported influence on future surgery decisions (Figure 3C, $P < 0.001$). Most patients without obvious postoperative discomfort reported that the experience would not affect future surgical decisions, whereas patients with symptoms more often reported an influence on future surgery decisions. Evidence from other surgical settings provides context for research on preoperative expectation guidance. A randomized controlled trial of 172 patients undergoing total knee arthroplasty showed that patients receiving structured preoperative education on realistic expectations had significantly higher postoperative satisfaction and a greater willingness to undergo repeat surgery than controls, suggesting that realistic expectation guidance can reduce negative experiences caused by unmet expectations (38). Although postoperative reactions in this survey were generally mild, whether postoperative symptom management and preoperative expectation

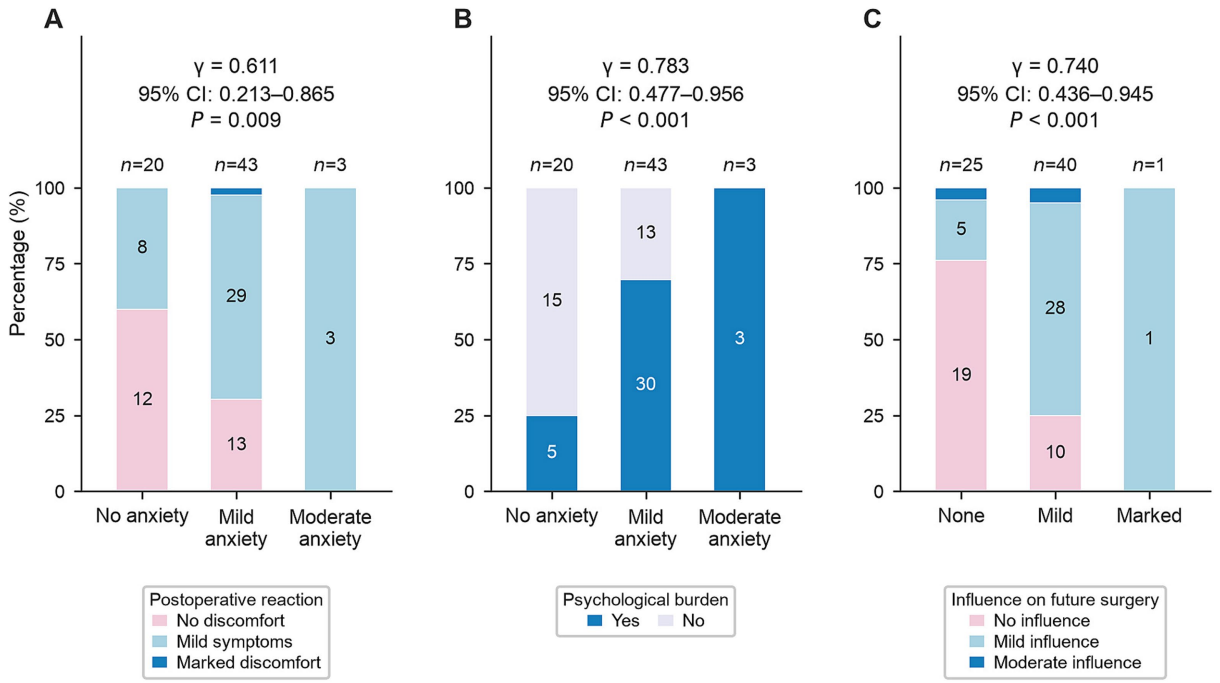

FIGURE 3
Ordinal associations among perioperative experiences and future surgery decisions. **(A)** Preoperative anxiety and postoperative reactions. **(B)** Preoperative anxiety and the influence of psychological burden on surgical choice. **(C)** Postoperative reactions and the influence on future surgery decisions. Stacked bars show percentages; numbers inside and above bars indicate counts and group totals, respectively. Unadjusted *p*-values are from linear-by-linear association tests; γ denotes the Goodman–Kruskal gamma coefficient and quantifies the direction and strength of each association. The 95% *CIs* for γ were obtained from 10,000 patient-level bootstrap samples.

guidance affect subsequent decisions requires prospective testing. Surgical avoidance was not measured. These three exploratory analyses did not adjust for other covariates or multiple comparisons; their associations require confirmation in larger longitudinal studies.

Several strengths of this study should be noted. First, patients were identified through consecutive screening of the entire periodontal surgical cohort over a 3.5-year period, and all 72 invited patients submitted questionnaires. Moreover, the study focused on a relatively homogeneous, procedure-specific population of patients who had actually undergone mucogingival surgery for gingival recession, allowing information-seeking behavior, preoperative anxiety, postoperative experiences, and the reported influence on future surgery decisions to be described within the same treated population. Second, the questionnaire was reviewed by experts and pilot-tested before formal administration, and electronic submission controls and quality screening were used to limit duplicate submissions, unanswered items, and potentially unreliable responses. Finally, questionnaire data were independently checked by two researchers before statistical analysis, further strengthening data quality.

This study has several limitations. A major limitation is recall bias: preoperative anxiety and information-seeking behaviors were recalled at the 6-month postoperative follow-up rather than measured before surgery. Postoperative experiences may have influenced these recollections and the observed associations; the direction and magnitude of this recall bias cannot be determined. Excluding six questionnaires may also have introduced selection bias, which could not be assessed because their individual records were not retained. The common follow-up time point limited variation in the recall period but did not eliminate this bias. All participants had already undergone surgery, and no patients who declined surgery were included. Decision-making items therefore describe respondents' perceived influences, not factors distinguishing surgical acceptance from refusal. The future-treatment item measured stated intentions rather than observed acceptance or avoidance. The education model had 30 events and four predictor parameters (EPV = 7.50); EPV ranged from 4.29 to 10.00 across the adjusted models. Sparse marital-status and insurance categories caused separation. Firth estimates addressed this estimation problem, but small categories still produced wide CIs. The models used limited demographic adjustment, and residual confounding remains possible. Covariate adjustment and category scoring were not documented in a prespecified analysis plan, so these findings should be considered exploratory. The ordered-score trend terms assume equal log-odds increments between adjacent categories. Because multiple comparisons were not adjusted, chance findings are possible. Without an *a priori* sample-size calculation, the study was not designed to ensure adequate power for the associations examined. These exploratory findings require validation in larger samples.

In addition, the single-choice information-source item could not capture multiple channels used by the same patient. Thus, the source proportions and regression outcome reflect the selected response, and patients who also consulted clinicians may have been classified otherwise. Although the questionnaire was reviewed by experts and pilot-tested in 10 patients, its validity and test–retest reliability were not formally evaluated. Preoperative anxiety was assessed using a self-designed four-level item rather than a validated scale, leaving its measurement precision uncertain. The two knowledge items were not validated as a scale and showed ceiling effects; they were therefore reported descriptively without a combined score.

The single-center sample included only treated Cairo RT1 patients who could independently complete an electronic questionnaire. Generalizability to other centers, other recession types, patients declining surgery, and patients unable to complete an electronic questionnaire is therefore limited.

Finally, the cross-sectional questionnaire survey design could not determine causal relationships between information-seeking behaviors and perioperative experiences. Future multicenter prospective studies with larger samples should employ validated psychometric scales to more accurately quantify psychological status and explore the effects of structured preoperative educational interventions on surgical acceptance and patient-reported outcomes.

Conclusion

Among patients with GR who had undergone mucogingival surgery, 93.94% reported learning about mucogingival surgery before treatment, and 45.45% selected professional healthcare staff as their information source. Higher education showed a positive trend with professional information seeking after age and sex adjustment, suggesting that education level may help guide future research on individualized oral health education. In addition, preoperative anxiety showed exploratory associations with postoperative reactions and psychological burden, while postoperative reactions were associated with the reported influence on future surgery decisions. These findings describe associations within a treated population and do not identify determinants of accepting or refusing surgery. Their relevance to individualized preoperative communication and education requires prospective evaluation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of the Hospital of Stomatology, Guangzhou Medical University (approval number: LCYJ2023055). The approved protocol covered questionnaire surveys of patients who had undergone surgery from July 2022 onward. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their electronic informed consent to participate in this study.

Author contributions

WL: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft. RP: Formal analysis, Visualization, Writing – original draft. SL: Data curation, Investigation, Writing – review & editing. MZ: Data curation, Investigation, Writing – review & editing. TZ: Data curation, Investigation, Writing – review & editing. YH: Funding acquisition, Writing – review & editing. WQ: Conceptualization, Formal analysis, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2026.1976153/full#supplementary-material

References

1. Reis MBL, Mandetta CMR, Dantas CDF, Marañón-Vásquez G, Taba M Jr, de Souza SLS, et al. Root coverage of gingival recessions with non-carious cervical lesions: a controlled clinical trial. *Clin Oral Investig*. (2020) 24:4583–9. doi: 10.1007/s00784-020-03325-1

2. Santamaria MP, Miguel MMV, Rossato A, Bonafé ACF, de Souza IV, Martins TM, et al. Volume-stable collagen matrix to treat gingival recession associated with non-carious cervical lesions: randomized clinical trial. *J Periodontol*. (2026) 97:62–73. doi: 10.1002/jper.11386

3. Cortellini P, Bissada NF. Mucogingival conditions in the natural dentition: narrative review, case definitions, and diagnostic considerations. *J Periodontol*. (2018) 89:S204–13. doi: 10.1002/JPER.16-0671

4. Marschner F, Lechte C, Kanzow P, Hraský V, Pfister W. Systematic review and meta-analysis on prevalence and risk factors for gingival recession. *J Dent*. (2025) 155:105645. doi: 10.1016/j.jdent.2025.105645

5. Zucchelli G, Mounssif I. Periodontal plastic surgery. *Periodontol*. (2015) 68:333–68. doi: 10.1111/prd.12059

6. Yılmaz M, Oduncuoğlu BF, Nişancı Yılmaz MN. Evaluation of patients' perception of gingival recession, its impact on oral health-related quality of life, and acceptance of treatment plan. *Acta Odontol Scand*. (2020) 78:454–62. doi: 10.1080/00016357.2020.1758773

7. Miller TA. Health literacy and adherence to medical treatment in chronic and acute illness: a meta-analysis. *Patient Educ Couns*. (2016) 99:1079–86. doi: 10.1016/j.pec.2016.01.020

8. McCaffery KJ, Holmes-Rovner M, Smith SK, Rovner D, Nutbeam D, Clayman ML, et al. Addressing health literacy in patient decision aids. *BMC Med Inform Decis Mak*. (2013) 13:S10. doi: 10.1186/1472-6947-13-S2-S10

9. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Bull World Health Organ*. (2007) 85:867–72. doi: 10.2471/BLT.07.045120

10. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet E-surveys (CHERRIES). *J Med Internet Res*. (2004) 6:e34. doi: 10.2196/jmir.6.3.e34

11. Yang S, Chen Y, Zhou L, Huang Y, Dai J. Willingness to adopt mHealth among Chinese parents during the COVID-19 outbreak: cross-sectional questionnaire study. *JMIR Mhealth Uhealth*. (2021) 9:e23155. doi: 10.2196/23155

12. An R, Chen W, Li S, Wu Z, Liu M, Sohaib M. Assessment of the oral health literacy and oral health behaviors among nurses in China: a cross-sectional study. *BMC Oral Health*. (2022) 22:602. doi: 10.1186/s12903-022-02658-5

13. Deeden S, Vichayanrat T, Asvanund Y, Prapansilp W, Phonghanyudh A. Knowledge, attitudes, and practices towards ECC prevention in Thai medical personnel. *Int Dent J*. (2024) 74:253–9. doi: 10.1016/j.identj.2023.08.008

14. Tsui PK, Chau PH, Wong JYH, Wang MP, Gao X, Lam OLT, et al. Oral care knowledge, attitude and practice among nursing staff in acute hospital settings in Hong Kong. *PLoS One*. (2023) 18:e0289953. doi: 10.1371/journal.pone.0289953

15. Tan L, Lin Z, Zhang Y, Sun N, Ding Q, Feng H, et al. Information-knowledge-attitude-practice model in non-suicidal self-injury behaviours of adolescence and young adults with major depressive disorder: randomised controlled trials. *J Psychiatr Ment Health Nurs*. (2025) 32:766–73. doi: 10.1111/jpm.13154

16. Yan LL, Liu K, Daviglus ML, Colangelo LA, Kiefe CI, Sidney S, et al. Education, 15-year risk factor progression, and coronary artery calcium in young adulthood and early middle age: the coronary artery risk development in young adults study. *JAMA*. (2006) 295:1793–800. doi: 10.1001/jama.295.15.1793

17. Heinze G, Wallisch C, Dunkler D. Variable selection—a review and recommendations for the practicing statistician. *Biom J*. (2018) 60:431–49. doi: 10.1002/bimj.201700067

18. Vazquez CE, Mauldin RL, Mitchell DN, Ohri F. Sociodemographic factors associated with using eHealth for information seeking in the United States: cross-sectional population-based study with 3 time points using health information National Trends Survey data. *J Med Internet Res*. (2024) 26:e54745. doi: 10.2196/54745

19. Heinze G, Schemper M. A solution to the problem of separation in logistic regression. *Stat Med*. (2002) 21:2409–19. doi: 10.1002/sim.1047

20. Wittink H, Oosterhaven J. Patient education and health literacy. *Musculoskelet Sci Pract*. (2018) 38:120–7. doi: 10.1016/j.msksp.2018.06.004

21. Margat A, Gagnayre R, Lombrail P, de Andrade V, Azogui-Levy S. Interventions en littératie en santé et éducation thérapeutique: une revue de la littérature [Health literacy and patient education interventions: A review]. *Sante Publique*. (2017) 29:811–20. doi: 10.3917/spub.176.0811

22. Jönsson B, Ohrn K, Lindberg P, Oscarson N. Evaluation of an individually tailored oral health educational programme on periodontal health. *J Clin Periodontol*. (2010) 37:912–9. doi: 10.1111/j.1600-051X.2010.01590.x

23. Stormacq C, Van den Broucke S, Wosinski J. Does health literacy mediate the relationship between socioeconomic status and health disparities? Integrative review. *Health Promot Int*. (2019) 34:e1–e17. doi: 10.1093/heapro/day062

24. Ju X, Jamieson LM, Mejia GC, Mittinty MN. Effect of oral health literacy on self-reported tooth loss: a multiple mediation analysis. *Community Dent Oral Epidemiol*. (2022) 50:445–52. doi: 10.1111/cdoe.12699

25. Lu X, Nanjappa S, Wijesiri TID, Mossey P, Yuan S. The role of health literacy in adults' dental service utilisation: a scoping review. *Community Dent Oral Epidemiol*. (2026) 54:133–45. doi: 10.1111/cdoe.70037

26. Wright KE, Luz DS, Dragan IF. Applying patient behavioral assessment to enhance dental implant treatment outcomes. *Compend Contin Educ Dent*. (2025) 46:336–42.

27. Seligman LD, Hovey JD, Chacon K, Ollendick TH. Dental anxiety: An understudied problem in youth. *Clin Psychol Rev*. (2017) 55:25–40. doi: 10.1016/j.cpr.2017.04.004

28. Kassem El Hajj H, Fares Y, Abou-Abbas L. Assessment of dental anxiety and dental phobia among adults in Lebanon. *BMC Oral Health*. (2021) 21:48. doi: 10.1186/s12903-021-01409-2

29. Tellez M, Potter CM, Kinner DG, Jensen D, Waldron E, Heimberg RG, et al. Computerized tool to manage dental anxiety: a randomized clinical trial. *J Dent Res*. (2015) 94:174S–80S. doi: 10.1177/0022034515598134

30. Armfield JM, Heaton LJ. Management of fear and anxiety in the dental clinic: a review. *Aust Dent J*. (2013) 58:390–407. doi: 10.1111/adj.12118

31. Gordon D, Heimberg RG, Tellez M, Ismail AI. A critical review of approaches to the treatment of dental anxiety in adults. *J Anxiety Disord*. (2013) 27:365–78. doi: 10.1016/j.janxdis.2013.04.002

32. Sanz M, Simion M. Surgical techniques on periodontal plastic surgery and soft tissue regeneration: consensus report of group 3 of the 10th European workshop on periodontology. *J Clin Periodontol*. (2014) 41:S92–7. doi: 10.1111/jcpe.12215

33. Ko KI, Sculean A, Graves DT. Diabetic wound healing in soft and hard oral tissues. *Transl Res*. (2021) 236:72–86. doi: 10.1016/j.trsl.2021.05.001

34. Cairo F, Couso-Queiruga E, Barbato L, Rupe C, Stuhr S, Chambrone L, et al. Clinician- and patient-reported outcomes following the surgical treatment of single gingival recession defects: a systematic review. *Periodontol*. (2025) 99:7–20. doi: 10.1111/prd.12641

35. Tonetti MS, Cortellini P, Pellegrini G, Nieri M, Bonaccini D, Allegri M, 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. doi: 10.1111/jcpe.12834

36. Qiao F, Zhang M, Zhang T, Zhu D. Dental anxiety is related to postoperative symptoms in third molar surgery. *Front Psych*. (2022) 13:956566. doi: 10.3389/fpsyt.2022.956566

37. Berggren U, Meynert G. Dental fear and avoidance: causes, symptoms, and consequences. *J Am Dent Assoc*. (1984) 109:247–51. doi: 10.14219/jada.archive.1984.0328

38. Nam HS, Yoo HJ, Ho JPY, Kim YB, Lee YS. Preoperative education on realistic expectations improves the satisfaction of patients with central sensitization after total knee arthroplasty: a randomized-controlled trial. *Knee Surg Sports Traumatol Arthrosc*. (2023) 31:4705–15. doi: 10.1007/s00167-023-07487-9