Patient experience of autogenous soft tissue grafting has an implication for future treatment: A 10-15-year cross-sectional study

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One sentence summary: Previous experience of the surgical treatment influences on their decision to have more autogenous soft tissue grafting.

Abstract

Background. Patient-reported outcomes have received a great deal of interest in periodontal plastic procedures. However, their evaluation has mainly been short-term. Thus, the aim of this study was to evaluate the impact of soft tissue grafting procedures conducted over a decade ago on the willingness of a patients to undergo the surgery again.

Methods. Subjects that received an autogenous soft tissue graft over 10 years ago were screened and invited for a survey. Their response was only analyzed if they were able to correctly identify the sites of the surgical procedures. Dichotomous questions and visual analogue scales (VASs) were used to assess self-reported pain, willingness to retreat and satisfaction.

Results. Fifty-two patients were included in the analyses. Higher pain was reported for mandibular sites, and treated areas including ≥ 3 teeth ($p<0.01$). Willingness to retreatment was 84.6% and it was negatively associated with self-reported pain measures, the arch location (mandible), and number of treated sites (≥3 teeth) ($p<0.01$). Mean satisfaction rate was 86.9 ± 13.65 (VAS) and showed a positive correlation with willingness to retreat ($p<0.01$). Having a complete root coverage at the recall visit was also significantly associated with higher patient satisfaction scores ($p<0.01$).

Conclusions. Patient experience of previous autogenous soft tissue grafting has an influence on their decision to undergo future treatment. Willingness to retreat was negatively affected by mandibular sites, larger treated areas and the perceived pain, while presenting with complete root coverage was significantly associated with patient satisfaction.

1. Introduction

Palatal soft tissue grafting was introduced in the mid '60 for increasing vestibulum depth and correcting mucogingival deformities, such as lack of keratinized or attached gingiva. [1, 2] Nowadays, autogenous soft tissue grafts are routinely used not only for increasing keratinized tissue and achieving for root coverage [3-5], but also in the context of alveolar ridge preservation [6, 7], guided bone regeneration [8], and peri-implant soft tissue reconstruction. [9-11] Although alternative materials have been introduced in an attempt to reduce patient morbidity [4, 12-15], autogenous soft tissue grafts are still considered the gold standard treatment for periodontal and peri-implant plastic surgeries. [16-20]

Several palatal harvesting approaches have been described throughout the literature. [21-23] Starting from the free gingival graft (FGG) that includes the superficial epithelium and involves a healing by secondary intention of the palatal donor site, other techniques for harvesting a sub-epithelial connective tissue graft (CTG) were also introduced and then categorized based on the number of incisions performed. [21, 22] These CTG harvesting approaches involve the preservation of a primary palatal flap that, after its partial thickness elevation and CTG harvesting, is sutured over the donor site in an attempt to achieve a healing by primary intention. Some authors investigated patient-reported outcomes measures (PROMs) following harvesting of FGG and CTG, concluding that superior discomfort and a more frequent incidence of complications can be expected with the FGG harvesting technique. [24-26] In particular, Wessel & Tatakis used questionnaires to assess the number of consumed analgesics, the duration they were taken, and post-operative pain, which were significantly higher in subjects who had received FGG. [26] Similarly, another study reported that FGG was three times more likely to result in post-surgical pain and bleeding compared to CTG. [25] More recently, Zucchelli et al. challenged this conclusion showing that FGG and CTG harvesting had similar patient morbidity and that analgesic consumption increased with graft height and in case of dehiscence or necrosis of the primary flap. [23] Later on, several trials investigated different treatment protocols for facilitating palatal donor site wound healing and decreasing patient morbidity following palatal harvesting, including the application of hemostatic collagen sponge, cyanoacrylate tissue adhesive or platelet concentrates on the donor site. [27-29] PROMs were used as the main endpoints in these studies [27-29]. Additionally, PROMs have progressively become important in clinical trials comparing different root coverage techniques, in terms of patient satisfaction, discomfort or self-reported esthetics. [4, 30, 31]

Nonetheless, despite the increasing attention that PROMs after soft tissue grafting have received, their evaluation has mainly been short-term, and throughout the first few weeks after the procedure or at

the last visit. Whereas patient perception following a soft tissue grafting procedure may indeed impact the willingness of a patient to undergo the surgery again, whether in the near or far future.

This aspect seems to be particularly crucial, as confirmed by several epidemiological studies in the medical field [32-34]. Furthermore, no study has yet looked into the long-term (over 10 years) pain assessment or patient self-evaluation of periodontal plastic surgeries, as it relates to post-op morbidity and how much, and if patients recognize the discomfort following a palatal harvesting procedure, and its effect after a decade.

Therefore, the aim of the present study was to evaluate the impact of autogenous soft tissue grafting procedures on the willingness of patients to undergo the procedure again, by focusing on patient-related factors and assessing clinical variables which may influence the outcomes.

2. Materials and Methods

2.1 Study design and participants

The current study was approved by the University of Michigan Medical School Institutional Review Board (IRBMED) (HUM00146261), in accordance with the Helsinki Declaration of 1975, as revised in 2000. An informed consent was obtained from all individuals who had participated in the study. The present manuscript follows the STROBE statement for improving the quality of reports of cross-sectional studies (http://www.strobe-statement.org/).

2.2 Participants, setting and study size

Subjects who had undergone a periodontal plastic surgery involving autogenous grafts (either FGG or CTG harvested with the single-incision approach [35]) between February 2004 and February 2009 at the University of Michigan School of Dentistry were screened and invited for a survey. The inclusion criteria were: 1) Previous information on the palatal harvesting technique, including date of the procedure and complications, if any, during the first month, 2) Patients willing to provide an informed consent and attend the study, and 3) absence of any further surgical procedure involving the palate. Each recruited subject contributed with a single experimental area consisting of one hemi-palate.

2.3 Variables

The following information were obtained from patient records:

- Age, sex, smoking habit and date of the soft tissue grafting procedure
- Soft tissue grafting technique, whether FGG or CTG (using the single-incision approach [35])
- Number and location of the treated teeth
- Status of the post-operative healing of the donor and recipient site, including complications in the first month such as flap dehiscence or necrosis, patient-reported bleeding and infection
- Prescription of additional medication (painkillers or antibiotics) after the 2-week post-op appointment until 4 weeks after the date of the surgical procedure

2.4 Study outcomes and patients' survey

The primary outcome was to evaluate the impact of a previous soft tissue grafting procedure, performed between 10 to 15 years ago, on patient perception of the periodontal plastic surgery (in terms of self-reported pain) and on the willingness of patients to undergo a similar surgery again, if necessary (binary variable of yes/no). In addition, patient satisfaction of the treatment outcome was also assessed. The secondary outcome was to explore the influence of patient- and procedure-related factors, including age, sex, technique (FGG or CTG), number of treated teeth, arch, post-operative complications, pain and the location of the gingival margin being/having remained at the level of the cemento-enamel junction (CEJ) as assumed to have obtained a complete root coverage, at the recall visit/questionnaire (for CTG only) on the willingness to undergo a similar procedure and on patient satisfaction.

The initial recruitment of patients was based on their confirmation of recalling the periodontal plastic surgery involving the palatal harvesting, its purpose, and the area of the oral cavity where the procedure had been performed. At the day of the recall visit, patients were asked again if they remembered the surgery and, in case of a positive answer, they were provided with a questionnaire which started with a question asking them to indicate the site on the palate where the soft tissue graft had been harvested from.

Data for the analyses was extracted only from the questionnaire of patient who had provided the correct answer to the initial question regarding the area of the palatal harvesting procedure.

The patients were asked to mark a 100 mm visual analogue scale (VAS)[36, 37] relative to the pain/discomfort that they had experienced from the overall procedure until 1 month after the surgery (cumulative response relative to their experience from the palatal harvesting, and the surgical recipient site). Patients had also been given the option to mark "I don't remember" if they did not recall the answer to one of the questions. However, the response to the following question was mandatory from all included participants: "Would you be willing to undergo the same procedure again, if necessary?". Patients were asked to elaborate their answer if their reply was "no" to this question.

Each patient was asked to fill out the questionnaires themselves to assure as little bias as possible.

Additionally, in case of more than four missing items in total or if the patient had answered "I don't remember" to more than four items, the questionnaire was regarded as invalid. The questionnaire was statistically determined only if the patients had provided the right answer to the initial question in regard to the area of the surgical procedure, and if less than 4 missing or "I don't remember" items existed.

2.5 Data Collection and statistical analysis

Data from the questionnaires were extracted by two investigators (LT & AK) and entered into two separate datasets which were then combined into a single spreadsheet which was designed for this study, that included the demographic data of the recruited participants (sex, age and smoking status at time of the procedure (yes/no)) along with clinical information such as the technique of harvesting, number of teeth involved, presence/absence of any post-op complications and complete root coverage at the recall visit.

Descriptive statistics were used to illustrate the overall gathered responses as means and standard deviations (SD). The outcomes of interest were the quantitative amount of perceived pain that was remembered after 10 years (continuous data), overall satisfaction of patients of the mucogingival procedure as assessed through the VAS scale (continuous variable), and the willingness to have the procedure again if needed (binary outcome of yes/no). Mixed-Linear (for continuous variable) and logistic (for binary outcome) regression models were produced depending on the stated outcomes to test the correlation between the gathered patient responses, demographics, and obtained clinical data to the stated variables of interest. In all analyses the type of treatment approach (FGG vs. CTG) was accounted for as well as time (since procedure) through inclusion of fixed-effect variables in the

model despite their level of significance. A stepwise regression approach was utilized to univariately introduce the variables of interest for testing their predictive values and kept for multi-variate modeling if obtained a p of < 0.05.

For significant predictors, the final coefficients from the muli-variate model was recorded, and subset analyses were performed for variables specifically correlated to the treatment approach (CTG, FGG) depending on the predictive value of an outcome.

The Odds ratios (OR) with their 95% confidence intervals were generated and a p value of 0.05 was set for statistical significance.

All analyses were performed in Rstudio‡ by a separate author (SB) with experience in biostatistics. The plots were produced using ggplot2 [38] package in R.

3. Results

3.1 Participants

Among the 149 potentially eligible patients for recruitment, sixty-eight patients (31 males and 37 females, with a mean age of 57.6 ± 12.5 years) were contacted and agreed in participating in the present evaluation. Among them, sixteen patients (23.5%) were excluded from the statistical analysis because they were not able to remember the perceived pain following the palatal harvesting. All subjects had correctly reported the side in which they received the harvesting. Thus, data from 52 patients (23 males and 29 females, with a mean age of 60 ± 12.07 years) were analyzed (Fig. 1). FGG was performed in 24 patients, while 28 received CTG. Twenty-nine procedures involved maxillary teeth, while twenty-three the lower dentition. Table 1 describes the characteristics of the included participants in the analysis.

3.2 Factors associated with patients' responses in terms of their perceived pain/discomfort

The pain scores for the gathered responses ranged from 0 to 51 with an average of 14.24 ± 15.84.

Results of the linear regression analysis demonstrated that among the investigated variables, the area of the surgical procedure (maxilla) was significantly associated to the less perceived pain (-9.11 (95%

CI[-13.53, -4.68], p<0.01)). Additionally, the number of treated sites was also found to be positively correlated with the pain responses (12.21 (95% CI[7.13, 17.29], p<0.001)). Whereas the technique (FGG or CTG)(-7.59 (95% CI[-16.97, 1.79], p=0.11)), sex (0.03 (95% CI[-9.62, 9.69], p=0.91)), smoking habit (-7.42 (95% CI[-18.31, 3.46], p=0.18)) or patients' age at the time of the procedure (-0.19 (95% CI[-0.58, 0.19], p=0.32)) were not factors significantly associated to the observed pain scores.

3.3 Willingness to undergo the same procedure

Overall patients seem to be favoring towards having the procedure again if needed as 84.6% of included participants (44 of 52) had responded that they would be willing to undergo the surgery again. Among the 8 individuals who had replied that they would not be willing to undergo the procedure again, the reasons were: "the harvesting from the palate was too painful" (3 patients), "it took several weeks before I could eat like before" (3 patients), "I was not expecting this amount of swelling and pain" (1 patient) or "it was too painful and expensive" (1 patient).

Logistic regression models showed that, while in general patients were in favor of having the procedure performed again, those who had the procedure done for an area in the maxilla were significantly more likely to undergo the surgery again compared to those who had the procedure done in the mandible (OR 4.58 (95% CI[2.98, 6.18], p=0.005)), as almost all participants in the maxilla group provided a favorable response, while gender (OR for male: 0.68 (95% CI[-0.88, 2.24], p=0.62)), age (OR 1.02 (95% CI[0.96, 1.08], p=0.44)), and smoking habit (OR 2.58 (95% CI[0.32, 4.847], p=0.39)) at the time of the surgery were not associated with the willingness to re-treat. However, a negative and significant correlation was found with the number of sites that were originally treated (OR 0.02 (95% CI[0.001, 0.158], p=0.001)). Additionally, when this was further analyzed by grouping the sites into treatment of 1 and 2 versus 3 and 4 teeth, it was shown that those who had undergone the procedure for the treatment of 3 or 4 sites were significantly less likely to accept the treatment again compared to those who the procedure for only 1 or 2 sites (0.01 (95% CI[0.0005, 0.1001], p<0.001)). Lastly, when the association between the perceived pain responses with patients' willingness for retreatment were tested, a strong correlation was observed, signifying that the less pain patients had reported at the time of the questionnaire, the more likely they were to undergo the procedure again (-25.24 (95% CI[-35.09, -15.397], p<0.001)).

3.4 Patient-reported satisfaction of the treatment

Based on the responses, it was observed that overall patients were satisfied with the treatment and its outcomes as the average response ranged from 66 to 100, with a mean of 86.9 ± 13.65 on the VAS scale.

Regression analyses revealed a significant correlation between the gathered satisfaction responses and area of the mucogingival procedure, such that the maxillary region was associated with a significantly higher satisfaction rate (8.2 (95% CI[0.35, 16.08], p=0.02)), as well the surgical technique being CTG (8.21 (95% CI[0.26, 16.16], p=0.02)) compared to FGG, and the number of the treated sites (-8.45 (95% CI[-13.22, -3.68], p<0.01)) while sex (male: -1.65 (95% CI[-9.97, 6.66], p=0.69)), and smoking (-0.54 (95% CI[-10.12, 9.037], p=0.87)) were not found to be significantly associated in the models.

Furthermore, a positive correlation was observed with patient satisfaction scores and their willingness for retreatment (13.17 (94% CI[7.78, 18.56], p<0.01)) (Fig 2).

Lastly, in the subset of patients who had been treated with a CTG, there was a statistically significant evidence that the probability of CRC was higher for subjects who responded with higher satisfaction scores (14.1 (95% CI[5.19, 23.01], p=0.004)) (Fig. 3). Fig. 4 illustrates the patient-reported pain and satisfaction scores in the mandible and maxilla according the treated number of sites.

4. Discussion

Assessment of patient reported outcome measures (PROMs) have become one of the primary endpoints of interventional studies. [4, 30, 39-42] Our findings showed that patient experience following autogenous soft tissue grafting can have a strong implication for future treatments. Indeed, periodontal plastic surgeries performed in the maxilla were found to be significantly less associated with the patients' perceived pain and a higher willingness for future retreatment (odds ratio 4.58) compared to procedures done in the mandible. It may be reasonable to assume that when the procedure is performed in the mandible patients might perceive it as involving two surgical sites (the treated area plus the palatal donor site), while in the maxilla only one quadrant is affected. Similarly, the higher

muscle pull of the mandible may cause additional discomfort during the healing.[43, 44] In addition, we found a strong correlation between self-reported pain and the willingness to undergo the procedure again. To the best of our knowledge, this is the first attempt to study the relationship between PROMS and their long-range effect on future treatment, including the correlation between morbidity, satisfaction and willingness to undergo the same procedure.

Patient morbidity, satisfaction and willingness for retreatment have been evaluated as endpoints in clinical trials aiming at comparing two or more treatments. [4, 13, 42, 45, 46] The present study also suggested that both methods of harvesting (FGG and the single incision technique for obtaining a subepithelial CTG) have similar patient morbidity, as previously demonstrated by Zucchelli et al.[23] Additionally, we found that surgical sites including ≥ 3 teeth were more likely to have higher pain responses and lower willingness to retreat. This may be due to the bigger graft width (in terms of mesio-distal dimensions), which is contradictory with previous studies have failed to demonstrate a correlation between perceived pain and graft width. [23, 27, 47] Nevertheless, it should be considered that the present investigation focused on patients' self-assessment of the treatment, that included the donor site and the recipient site. Thus, larger treated areas may have been the main determinant for our finding of higher reported pain scores. It should also be noted that the surgical techniques and instruments we use today allow for minimally invasive procedures that can significantly reduce patient morbidity, the ensuing bleeding, and improve wound healing and clinical outcomes. [48-52]

We also observed an overall patient satisfaction of 86.9 over 100, with significantly higher scores for CTG compared with FGG. This may have been due to their different indications, CTG mainly being used for covering gingival recessions and improving esthetics, whereas FGG for increasing keratinized tissue.[53] This may explain why patient perception of the esthetics is higher for CTG. [54-56] Indeed, in patients who had been treated with CTG for root coverage purposes, those that presented with a complete root coverage at the time of the recall visit were significantly associated with higher satisfaction scores, regardless of the pain reported. This finding suggests not only morbidity, but also esthetic outcomes and satisfaction play an important role on patients' perception of the treatment and their willingness to undergo the same procedure again. In line with this assessment, a recent randomized clinical trial reported that physiological discomfort, psychological- and social- disability had a negative correlation with esthetic outcomes. [42]

Two recent long-term studies from our group investigated patient satisfaction and willingness for retreatment following root coverage procedures with different graft materials. [46, 57] Satisfaction scores were in line with the ones of the present study. Interestingly, it was also found that patients that had inquired about the root coverage treatment primarily for esthetic purposes were also the most accurate in detecting of whether their post-treatment results were stable over time. [46, 57] The fact that these two studies reported a superior willingness for retreatment compared to the present investigation (100% vs 84.6%, respectively) can be explained by the fact those had mainly included maxillary gingival recessions for root coverage purposed and had either utilized a allograft graft [57] or a relatively small CTG. [46] Indeed, the present results showed that maxillary sites, and treated area including only 1 or 2 teeth were correlated with significantly higher satisfaction and willingness for retreatment. The lower root coverage outcomes typically obtained observed in the mandibular region[43, 50] may have also attributed to the lower patient satisfaction in our analysis. A recent case series with a 10-year follow-up reported 80% willingness for retreatment with CTG, results of which are in line with our findings.[40] Nonetheless, the authors of the mentioned study did not find a correlation between satisfaction (measured using school grades) and willingness to retreatment [40], while our results showed that satisfaction scores were positively correlated with willingness for retreatment. The methods for assessing satisfaction (school grades in the study of Petsos et al. [40] vs VAS in the present study) as well as different population/geographic location (Germany vs United States) may have contributed to this different finding.

Among the limitations of the present study it should be mention that different clinicians had performed the surgical procedures, and that the dimensions of the grafts as well as the surgical techniques at the recipient site were not standardized. The patients were enrolled in different maintenance programs, which according to some reports can influence the outcomes of soft tissue procedures over time. [17, 57, 58] Nevertheless, the main aim of the present investigation was to explore the impact of patients' experience after soft tissue grafting on future treatment. Lastly, regardless of our conscious and stringent efforts for obtaining reliable (through exclusion of those who did not correctly identify the surgical sites) and objective pain scores (through the VAS scale), we acknowledge that pain itself is subjective and its perception and recollection may vary substantially from individual to individual, and thus we encourage future investigations on these outcomes in a more controlled manner, and readers to bear in mind these limitations while quoting our results.

5. Conclusions

Patient experience of previous autogenous soft tissue grafting has an influence on their decision to undergo future treatment. Willingness to retreat was negatively affected by mandibular sites, larger treated areas and the perceived pain, while presenting with complete root coverage was significantly associated with patient satisfaction.

Footnotes

‡ Rstudio Version 1.1.383, Rstudio, Inc., Massachusetts, USA

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Tables and Figures Legends

Figure 1. STROBE flowchart

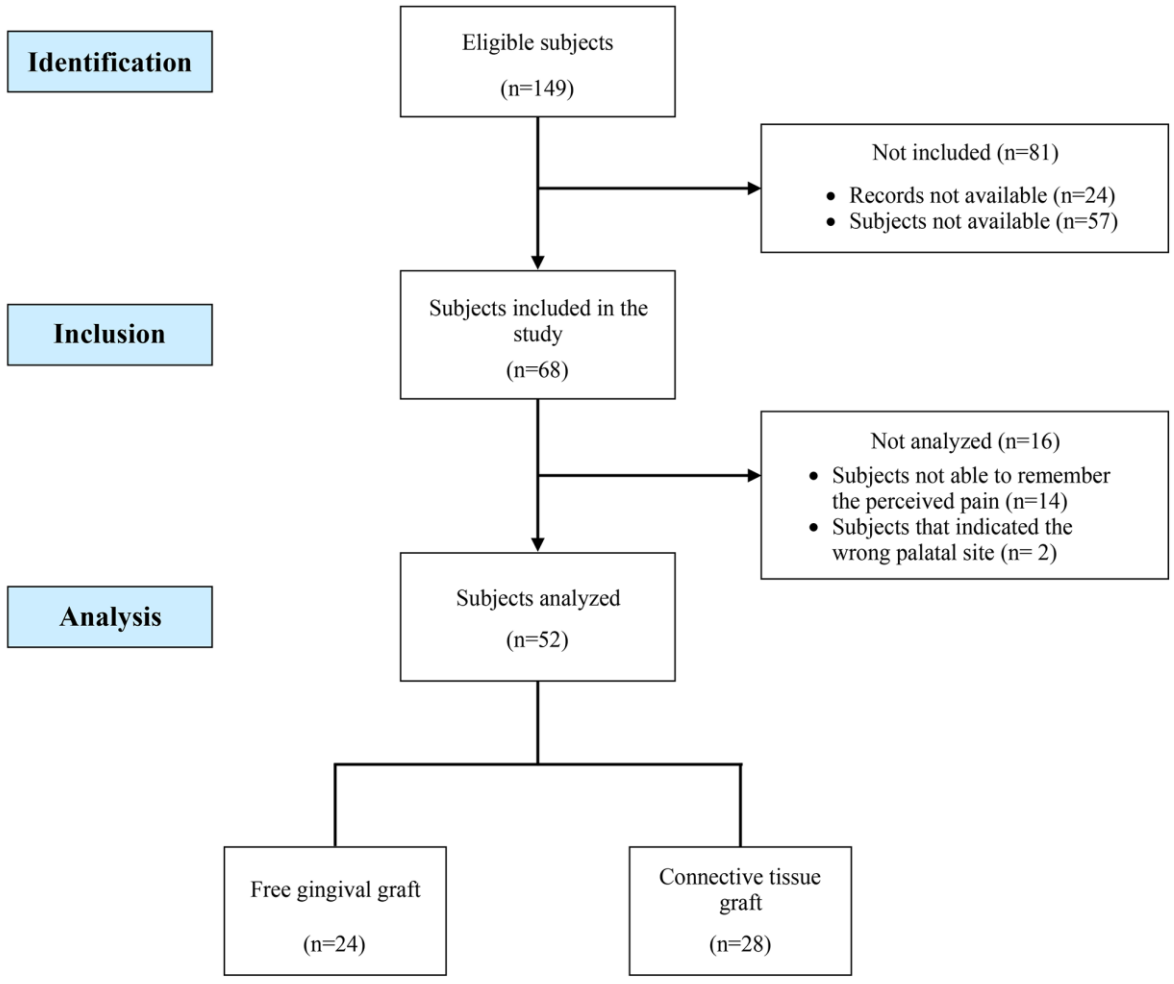

Figure 2. The plotted correlation between the patients' gathered satisfaction responses and their willingness for retreatment. Note that the node sizes are plotted proportional to the pain responses, and do not reflect other information or correlation.

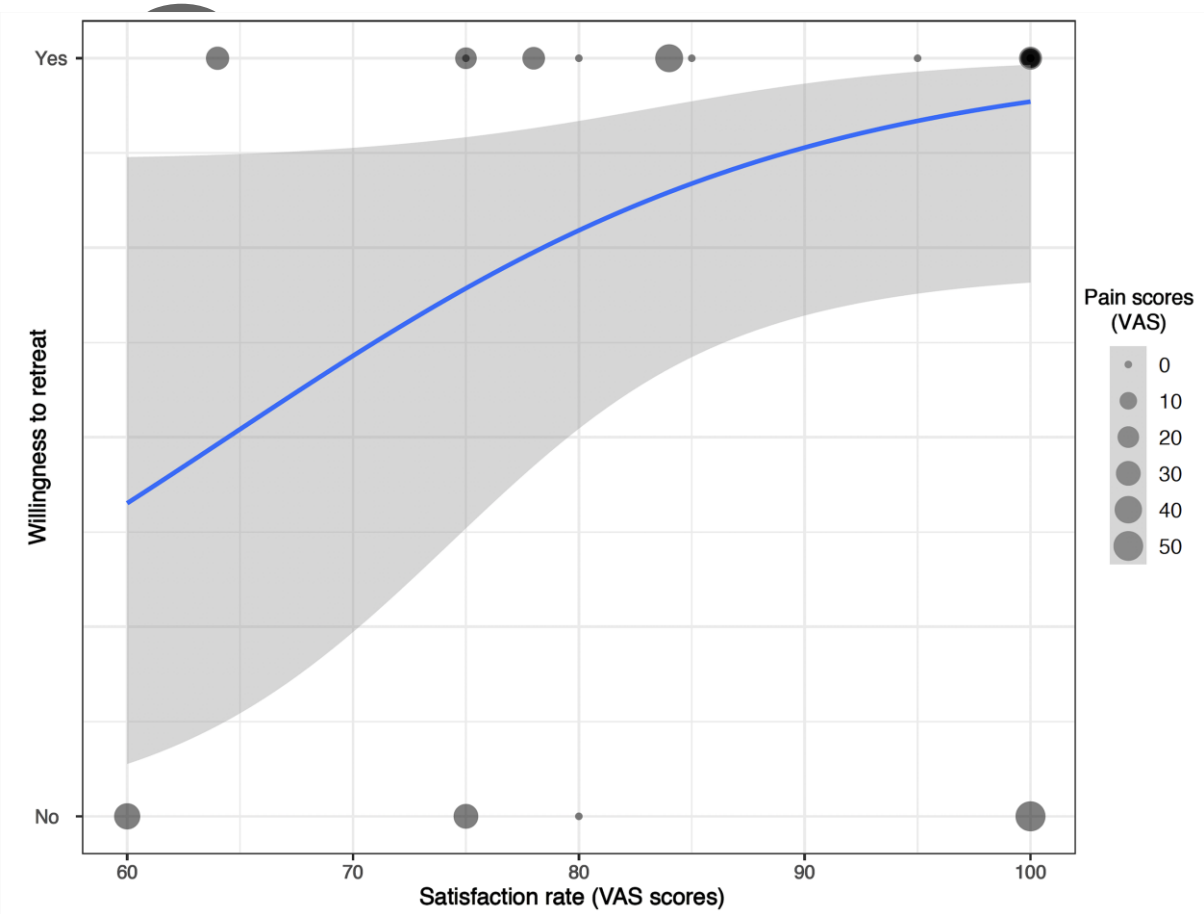

Figure 3. Plotted logistic regression model demonstrating correlation between presenting with complete root coverage and obtained VAS scores for satisfaction.

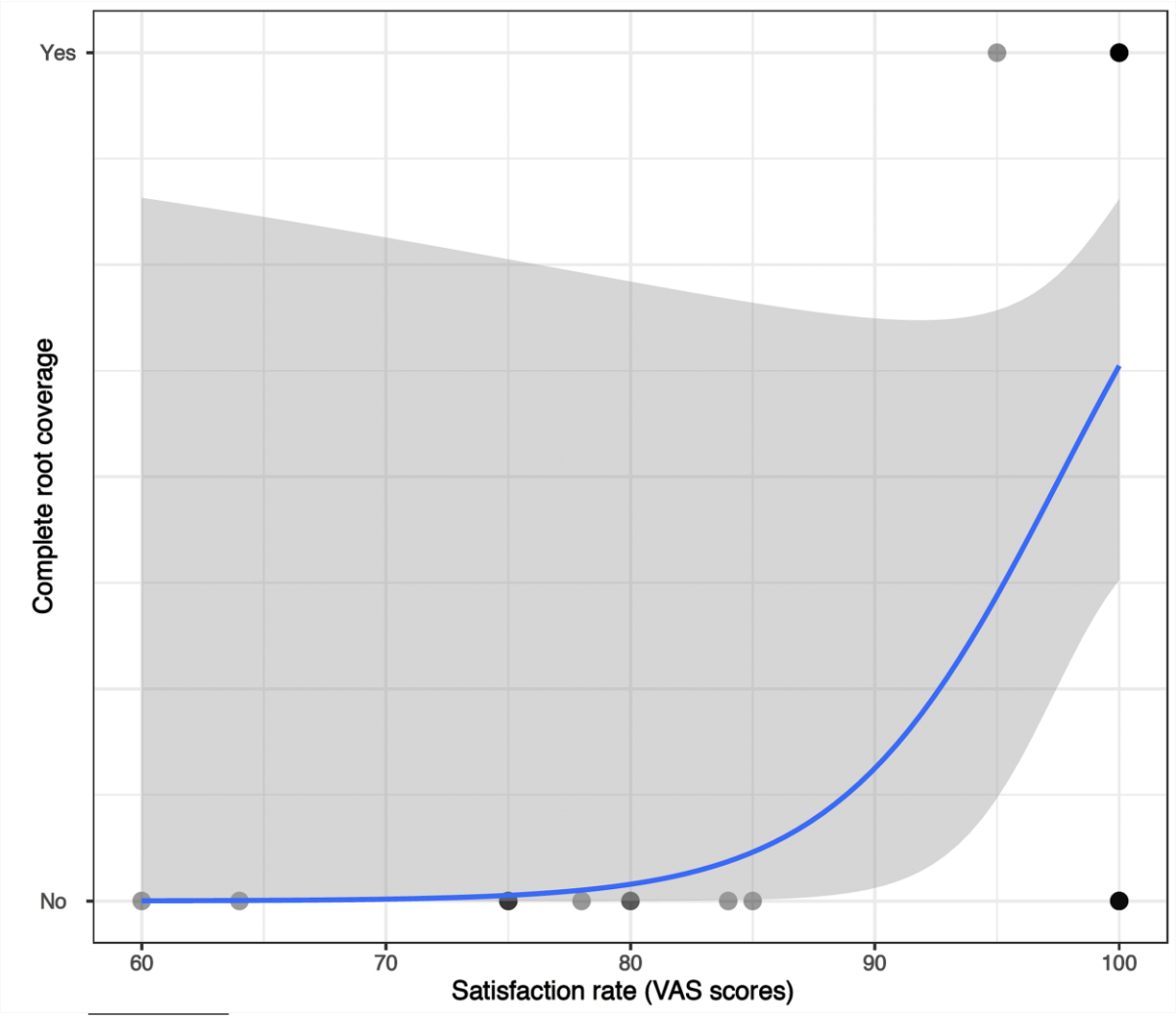

Figure 4. Patient-reported pain outcomes and satisfaction scores in the maxilla and the mandible (A) and in 1-2 vs 3-4 teeth (B). * denotes statistically significant difference between the compared groups.

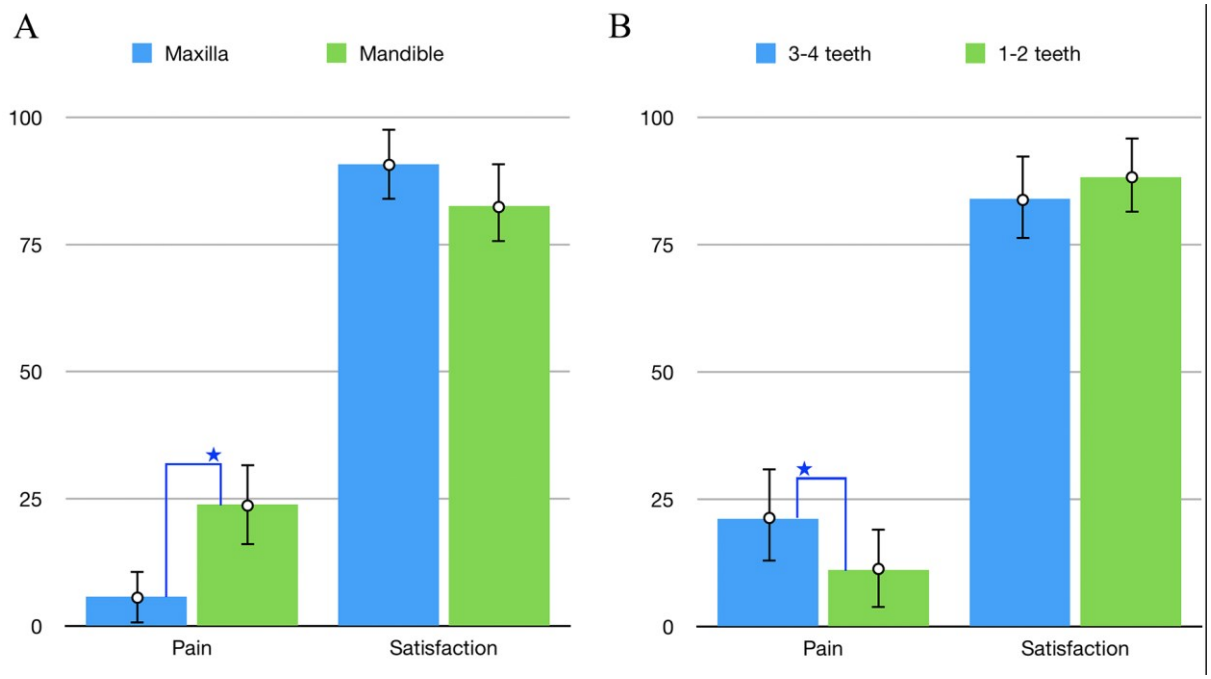

Table 1. General overview of the characteristics of the recruited patients included in the analysis for the long-term self-assessment

Characteristics (n = 52)	Value
Participants (n)	52
Sex	
Male	23
Female	29
Age	
At the time of the procedure	48.7 ± 12.2
At the time of questionnaire	60 ± 12.07
Technique of harvesting	
FGG	24
CTG	28
Area of procedure	
Maxilla	29

Mandible	23
Number of sites treated	
1	14
2	22
3	10
4	6

Values are presented as mean ± standard deviations (SD)

N, number; FGG, free gingival graft; CTG, connective tissue graft