Patient morbidity at the palatal donor site depending on gingival graft dimension

Ryzyko powikłań miejsca dawczego na podniebieniu w zależności od długości i grubości przeszczepu dziąsłowego

Beata Wyřbek^{A,B,D–F}, Bartłomiej Górski^{A–F}, Renata Górka^{A,C,E,F}

Department of Periodontology and Oral Diseases, Medical University of Warsaw, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of the article

Dental and Medical Problems, ISSN 1644-387X (print), ISSN 2300-9020 (online)

Dent Med Probl. 2018;55(2):153–159

Address for correspondence

Beata Wyřbek
E-mail: beatawyrebek@gmail.com

Funding sources

None declared

Conflict of interest

None declared

Received on January 13, 2018
Reviewed on March 28, 2018
Accepted on May 21, 2018

Abstract

Background. Autogenous gingival grafts are considered the gold standard procedure with proven clinical success when it comes to gingival augmentation. Different graft harvesting procedures have been described in the literature. Understanding which factors might affect the level of discomfort (morbidity) that patients are likely to experience and oral health-related quality of life outcomes in general seems to be crucial.

Objectives. An evaluation of patients' morbidity depending on the free gingival graft (FGG) dimension.

Material and methods. Sixty patients were divided into 3 groups depending on the length of their graft (group L1: ≤ 10 mm, group L2: 10–20 mm, group L3: ≥ 20 mm) and into 2 groups depending on the thickness of the graft (group T1: ≤ 2 mm, group T2: > 2 mm). Discomfort at the donor site was evaluated 1 week postoperatively, using a visual analog scale (VAS).

Results. With the length of the FGG, the mean VAS scores for pain, bleeding, eating and speaking disorders, stress and interference with social life increased. Analgesic consumption increased with the length of the graft. The thicker the grafts, the less discomfort and pain, and more problems with speaking, stress, daily and work routines occurred; however, without statistical significance.

Conclusions. No differences were demonstrated in the postoperative patients' morbidity between the examined groups; however, pain gradually increased with the FGG length and width.

Key words: visual analog scale, free gingival graft, patient comfort

Słowa kluczowe: wizualna skala analogowa, wolny przeszczep dziąsłowy, komfort pacjenta

DOI

10.17219/dmp/91406

Copyright

© 2018 by Wrocław Medical University
and Polish Dental Society
This is an article distributed under the terms of the
Creative Commons Attribution Non-Commercial License
(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Autogenous gingival grafts are still considered the gold standard procedure with proven clinical success when it comes to gingival augmentation.¹ The palate is the most frequent donor site for grafts.² Different graft harvesting procedures have been described in the literature.^{3–6} A whole free gingival graft (FGG) may be used at the recipient site or a graft may be deepithelialized after harvesting from the palate in order to get a subepithelial connective tissue graft (CTG).⁷ Both can be used to increase tissue thickness, to cover gingival recession and/or to prevent the development and progression of gingival recession.¹

There are numerous studies about the efficiency and predictability of different proposed surgical techniques on the recipient site as well as on the donor site.^{1,2,5,8} Surgical techniques depend on several factors, such as the size of the recession defect, the width of keratinized tissue, the depth of the vestibule, and the quality of the tissue on the palate.^{1,6,7,9,10} After FGG harvesting, the donor site becomes an open wound that may generate postoperative inconveniences for patients. Discomfort, pain and bleeding at the donor site after the FGG procedure are widely described in the literature.^{2,5,11} However, there is limited information about patient-reported outcomes after surgical treatment depending on different thicknesses and lengths of the graft. In order to assess how a certain treatment affects patients' quality of life, the following components should be taken into account: 1. level of pain/discomfort; 2. ability to function (eating, chewing, speaking); 3. psychological well-being (stress); and 4. social well-being (socializing, eating/speaking in front of others). Without a doubt, it is of value to include patient-related outcomes in relation to quality of life measures after soft tissue grafts in clinical trials.^{2,12}

The aim of this clinical study was to compare the postoperative morbidity at the donor site 1 week after the FGG procedure in reference to 3 different graft lengths and 2 different graft thicknesses.

Material and methods

Study population

The study included 60 Caucasian individuals of both genders (20 male and 40 female), aged 19–57 years, who were treated in the Department of Periodontology of the Medical University of Warsaw in Poland. The study protocol was planned in accordance with the ethical principles of the Declaration of Helsinki of 1975, as revisited in 2000, and approved by the Ethics Committee of the Medical University of Warsaw (KB/233/2014). The patients recruited had mucogingival problems qualifying them for surgery: thin biotype, a narrow zone of keratinized gingiva (≤ 1 mm) and multiple gingival recession on

the facial aspect of the mandibular anterior area. All participants received oral hygiene instructions. Full-mouth plaque scores (FMPS)¹³ and full-mouth bleeding scores (FMBS)¹⁴ were recorded initially and after scaling and selective root planning of the tooth. Non-surgical therapy was performed until FMPS $\leq 20\%$ and FMBS $\leq 20\%$ were reached before surgery. All patients agreed to participate in the study and signed written informed consent. Exclusion criteria comprised smoking, age < 18 years, presence of periodontal disease, conditions and/or medication that could interfere with periodontal tissue health or healing, pregnancy/lactating, or previous periodontal surgery on the involved sites. Two patients were excluded from the research due to delayed check-up appointments (after 10 days).

Study design

The participants of the study were divided into 3 groups based on the length (mesial-distal dimension) of the graft: in group L1 the graft was ≤ 10 mm long (20 patients), in group L2 the graft was 10–20 mm long (20 patients) and in group L3 the graft was ≥ 20 mm long (20 patients). Based on the thickness of the graft, the patients were divided into 2 groups: in group T1 the graft was < 2 mm thick (30 patients) and in group T2 the graft was ≥ 2 mm thick (30 patients). The length and the thickness of the FGG were evaluated immediately after being harvested. The measurements were made with a manual periodontal probe and rounded up to the nearest millimeter (PCP UNC 15; Hu-Friedy, Chicago, USA) (Fig. 1, 2). The height (apical-coronal dimension) of the FGG was the same in all cases, equal to 5 mm. All assessments were performed by the same experienced clinician (B.W.).

Harvesting the graft

All surgical procedures were performed under local anesthesia with 2% lidocaine with 1:100,000 epinephrine by one of the authors (B.G.), according to the technique described by Sullivan and Atkins³ and developed by Miller,¹⁵ using microsurgical principles. In brief, a horizontal partial-thickness incision of the length of the FGG was traced

Fig. 1. Free gingival graft taken from the palate. The thickness of the FGG was evaluated with a periodontal probe immediately after being harvested

Fig. 2. Free gingival graft taken from the palate. The length of the FGG was evaluated with a periodontal probe immediately after being harvested

2 mm apically to the gingival margin of the upper teeth. Two vertical incisions of 5 mm length were performed to delimitate the height of the graft and a second horizontal incision was made. Subsequently, the blade was oriented almost parallel to the superficial tissue along the coronal horizontal incision, once an adequate tissue thickness was obtained and the FGG was removed from the palate donor site. The palatal wound was protected with a hemostatic sponge (Equispon®; Equimedical, Zwanenburg, the Netherlands) maintained with polyamide sutures 5–0 (Seralon®; Serag Wiessner, Naila, Germany). A palatal stent was placed over the palatal area.

Postoperative care

Patients received 400 mg of ibuprofen at the beginning of the surgical procedure and 200 mg on its completion. Subsequent doses were taken only if required to control postoperative pain and edema. Patients were asked to record the quantity of analgesics taken. Chlorhexidine solution (0.2%) was administered 3 times a day for 1 min, and tooth brushing in the surgical areas was discontinued. The palatal stent was routinely used for the 1st postoperative week. The sutures were removed 10 days after surgery.

Discomfort assessments

One week after surgery, all patients were called for a check-up visit and requested to fill out a questionnaire. A visual analog scale (VAS) was used to measure the patients' postoperative discomfort. In the questionnaire, the respondents specified their level of 9 pre-selected issues by indicating a position along a continuous line between 2 end-points on a scale of 100 mm length.¹⁶ Patients were asked about: 1. post-surgery discomfort; 2. post-surgery pain; 3. palate bleeding (at the donor site); 4. eating disruption; 5. speaking disruption; 6. stress/tension; 7. disruption of daily activities; 8. work disruption; and 9. social life disruption. Moreover, there was 1 question about the number of analgesics taken for pain relief.

Discomfort was defined as any disruption in daily functioning, summarizing all normal activities experienced by the patients during the 1st postoperative week due to the palatal wound. Bleeding was considered as prolonged (longer than on the surgery day) hemorrhaging from the palate during the postsurgical week. Eating disruption was described as discomfort, such as pain or changes in the taste of food, while eating due to the palatal wound. Stress was evaluated based on the level of apprehension or fear experienced by the patients due to the palatal wound. Daily routine, work and social life disruption were defined as lower activities than normal in these areas. Postoperative pain was controlled with ibuprofen as described above. Subsequent doses that were taken were recorded in the questionnaire.

Statistical analysis

Statistical analysis was computed using R 3.3.1.¹⁷ To test the significance between 2 means (groups divided by the graft length and thickness), a univariate (one-way) analysis of variance (ANOVA) and Student's t-test were used, respectively. To compare a change in categorical variables in 2 groups, a χ^2 test was used. A p-value <0.05 was considered statistically significant.

Results

The participants of the study were divided into 3 groups based on the length of the graft: in group L1 the graft was ≤ 10 mm long, in group L2 the graft was 10–20 mm long and in group L3 the graft was ≥ 20 mm long. The results are presented in Table 1 and Fig. 3. There was no statistically significant difference between L1, L2 and L3 in terms of discomfort (25.1, 27.4 and 19.4, respectively, on the 0–100 VAS). Pain and bleeding gradually increased with a greater graft length, but neither parameter was statistically significant (19.6, 24.2 and 35.6, respectively, for pain, and 4.0, 4.2 and 14.2, respectively, for bleeding in L1, L2 and L3 on the 0–100 VAS). Similarly, eating was more constricted with greater graft length, but also without statistical significance (29.1, 45.4 and 48.7, respectively, in L1, L2 and L3 on the 0–100 VAS). The longer the graft, the more problems with speaking occurred (15.4, 19.5 and 23.5, respectively, in L1, L2 and L3 on the 0–100 VAS) and there were more patients with stress (17.8, 18.4 and 24.5, respectively, in L1, L2 and L3 on the 0–100 VAS) and problems in social life (10.5, 16.2 and 16.6, respectively, in L1, L2 and L3 on the 0–100 VAS). The level of disruption of daily routine (7.5, 12.3 and 11.5, respectively, in L1, L2 and L3 on the 0–100 VAS) and work (11.7, 10.6 and 15.0, respectively, in L1, L2 and L3 on the 0–100 VAS) did not seem to have any connection with the length of the graft.

Table 1. The comparison between the groups with regard to the graft length

Variable	L1	L2	L3	p-value
	mean (SD)	mean (SD)	amean (SD)	
Ibuprofen [mg]	146	100	400	0.022
Discomfort [VAS]	25.1 (25.5)	27.4 (23.9)	19.4 (20.3)	0.622
Pain [VAS]	19.6 (25.1)	24.2 (25.0)	35.6 (31.0)	0.389
Bleeding [VAS]	4.0 (9.7)	4.2 (11.3)	14.2 (21.7)	0.250
Eating [VAS]	29.1 (23.4)	45.4 (27.8)	48.7 (22.1)	0.119
Speaking [VAS]	15.4 (26.1)	19.5 (23.7)	23.5 (26.0)	0.754
Stress [VAS]	17.8 (19.0)	18.4 (26.2)	24.5 (25.0)	0.722
Daily routine [VAS]	7.5 (19.3)	12.3 (16.0)	11.5 (15.0)	0.798
Work [VAS]	11.7 (26.4)	10.6 (16.9)	15.0 (20.4)	0.831
Social life [VAS]	10.5 (18.6)	16.2 (24.3)	16.6 (22.5)	0.683

L1 – graft length ≤ 10 mm; L2 – graft length 10–20 mm; L3 – graft length ≥ 20 mm; SD – standard deviation; VAS – visual analog scale; except for the amount of ibuprofen, the means represent the positions along a continuous line between 2 end-points on a scale from 0 to 100, where 0 means no disruption and 100 means serious disruption; $p < 0.05$ considered statistically significant.

Fig. 3. The results for 9 pre-selected issues based on the length of the graft L1 – graft length ≤ 10 mm; L2 – graft length 10–20 mm; L3 – graft length ≥ 20 mm; the patients estimated the position of the 9 issues along a continuous line between 2 end-points on a scale of 100 mm length (VAS – visual analog scale), presented above as a bar chart.

Based on the thickness of the graft, the patients were divided into 2 groups: in group T1 the graft was < 2 mm thick and in group T2 the graft was ≥ 2 mm thick. The results are presented in Table 2 and Fig. 4. There were no statistically significant differences between the groups. Discomfort (19.9 and 29.9, respectively, in T1 and T2 on the 0–100 VAS) and pain (22.3 and 32.6, respectively, in T1 and T2 on the 0–100 VAS) were lower with a thicker graft. Bleeding (8.6 and 7.8, respectively, in T1 and T2 on the 0–100 VAS), problems with eating (42.9 and 41.3, respectively, in T1 and T2 on the 0–100 VAS) and disruption of social life (16.4 and 12.3, respectively, in T1 and T2 on the 0–100 VAS) were slightly lesser when the graft was thicker. Moreover, eating (42.9 and 41.3, respectively, in T1 and T2 on the 0–100 VAS) was not more constricted with a thicker graft. The thicker the graft was, the more problems with speaking occurred (18.5 and 20.5, respectively, in T1 and T2 on the 0–100 VAS). Similarly, the level of stress (19.6 and 20.5, respectively, in T1 and T2 on the 0–100 VAS), disruption of daily routine (10.3 and 11.0, respectively, in T1 and T2 on the 0–100 VAS) and work (10.6 and 13.6, respectively, in T1 and T2 on the 0–100 VAS) were higher with an increased graft thickness.

Fig. 4. The results for 9 pre-selected issues based on the thickness of the graft T1 – graft thickness < 2 mm; T2 – graft thickness ≥ 2 mm; the patients estimated the position of the 9 issues along a continuous line between 2 end-points on a scale of 100 mm length (VAS – visual analog scale), presented above as a bar chart.

Table 2. The comparison between the groups with regard to the graft thickness

Variable	T1	T2	p-value
	mean (SD)	mean (SD)	
Ibuprofen [mg]	200	200	–
Discomfort [VAS]	19.9 (19.7)	29.9 (26.2)	0.198
Pain [VAS]	22.3 (25.6)	32.6 (29.0)	0.252
Bleeding [VAS]	8.6 (17.2)	7.8 (16.2)	0.882
Eating [VAS]	42.9 (34.1)	41.3 (17.8)	0.858
Speaking [VAS]	18.5 (23.6)	20.5 (25.9)	0.802
Stress [VAS]	19.6 (21.5)	20.5 (24.1)	0.898
Daily routine [VAS]	10.3 (18.3)	11.0 (15.2)	0.892
Work [VAS]	10.6 (21.9)	13.6 (19.8)	0.663
Social life [VAS]	16.4 (24.5)	12.3 (18.8)	0.578

T1 – graft thickness < 2 mm; T2 – graft thickness ≥ 2 mm; SD – standard deviation; VAS – visual analog scale; the means represent the positions along a continuous line between 2 end-points on a scale from 0 to 100, where 0 means no disruption and 100 means serious disruption; $p < 0.05$ considered statistically significant.

The mean painkiller consumption in group L1, L2 and L3 was 0.73 tablet, 0.5 tablet, 2 tablets, respectively. There was no statistically significant difference between group L1 and L2 ($p = 0.666$), and between group L1 and L3 ($p = 0.061$); however, there was one between group L2 and L3 ($p = 0.005$). Patients from group L3 received significantly more additional ibuprofen (on average 400 mg) compared to patients from group L1 (on average 146 mg) and patients from group L2 (on average 100 mg). The mean painkiller consumption in groups T1 and T2 was the same – 1 tablet.

Discussion

The palatal mucosa is commonly used as a graft donor site. Gingival grafts harvested with the epithelium can be used either directly as a FGG or as a subepithelial CTG after de-epithelialization outside the oral cavity. Soft tissue grafts can be used to increase the width of keratinized gingiva and tissue thickness.^{2,4,6,18} The surgical wound on the palate heals by secondary intention within 2–4 weeks^{3,5,7,11,19} (Fig. 5A–C). According to the literature, this procedure has been associated with discomfort for the patient due to postoperative pain and/or bleeding at the donor site.^{2,5,19,20} Recently, patients' subjective assessment of medical procedures has gained in importance in healthcare, thus patients' expectations might be crucial in the selection of treatment measures. However, to the best of our knowledge, this is the first clinical study that has analyzed the patient's subjective morbidity at the donor site after FGG harvesting depending on the thickness and length of the FGG. We tried to evaluate how different components of patients' life quality were changing during the early healing phase after the FGG harvesting procedure. One week seems to be an adequate period to properly assess pre-selected subjective issues connected with the donor site, although healing lasts 2–4 weeks.^{7,11,19} Since patient-reported outcomes are crucial to understand the effects of treatment on patients' quality of life during the early period of healing, they should be taken into consideration by clinicians while planning treatment.^{2,12,19}

In our study, we evaluated all 4 components that constitute the well-being of patients. Although the differences mentioned were not statistically significant, they allowed

for certain relationships to be observed. With an increased FGG length, patients reported greater pain, bleeding from the donor area and difficulty in eating and speaking. These aspects were reflected in the amount of analgesics administered (apart from 600 mg ibuprofen taken before and immediately after the procedure). Patients from group L3 received significantly more additional ibuprofen (on average 400 mg) compared to patients from group L1 (on average 146 mg) and group L2 (on average 100 mg). The length of the FGG was not reflected in the patients' reported general discomfort or impediments to daily routines or work. However, the level of general stress was higher in group L3, which was influenced by the above-mentioned difficulties in eating and speaking, which also translated into more problems in social contacts.

With regard to the thickness of the graft, the problems reported by patients were a little different. As the thickness of grafts increased ($\text{FGG} \geq 2 \text{ mm}$), general discomfort, speech disorders, stress levels, and difficulties in daily routines and work also increased. The FGG thickness did not affect the amount of administered painkillers, although the pain was greater in the group with thicker grafts. The variables were evaluated subjectively by indicating individualized responses of each patient, which further impeded their interpretation as well as comparison with reports from other researchers. In another study, the mean VAS pain scores 3 days and 3 weeks after the FGG surgery were 48 and 36, respectively.²¹ Similarly, Zucchelli et al. compared the complaints reported by patients according to the size of prepared transplants.²² In the "big graft group", the thickness of the FGG was $\geq 2 \text{ mm}$ and the height was $\geq 4 \text{ mm}$, while in the "small graft group", the thickness was $< 2 \text{ mm}$, and the height was $< 4 \text{ mm}$. The authors did not take into account the length of the transplant. With the increase in the graft thickness and size, patients reported greater discomfort, palatine bleeding and difficulties while eating, which only in part coincided with the results of this work. The consumption of painkillers also increased (2520 mg of ibuprofen vs 1100 mg). The amount of nonsteroidal anti-inflammatory drugs (NSAIDs) taken was far greater than in our work, which might be related to the way in which the donor site was protected – for that purpose Zucchelli et al. used only equine-derived collagen without a palatal stent.²²

Fig. 5. A – the palatal wound after the graft has been harvested, the surgical wound on the palate heals by secondary intention; B – the palate condition after 3 weeks; C – the palate condition after 4 weeks.

When it comes to patients' subjective assessment of the healing period after the FGG procedure, the type of covering method for the palate may be of utmost importance.^{4,5,11,20,23} Eltas et al. compared the effects of a periodontal dressing, the Essix retainer, the modified Essix retainer, and modified Hawley retainer on pain, chewing, speaking, and appearance.²³ Using a periodontal dressing was associated with more pain and bleeding after 1 week post-surgery; however, the speaking and appearance VAS scores were lower. In light of the above, retainers might be the most appropriate in terms of pain and bleeding, but less ideal for speaking and appearance comfort. In other studies, hyaluronic-acid gels as well as platelet-rich fibrin (PRF) were applied at the donor site after FGG harvesting. Both PRF and hyaluronic-acid may provide significant benefits for wound healing parameters and reduce pain.^{24,25} In our study, all patients were administered palatal stents. Thus complaints about the donor site (discomfort, pain, bleeding) might have decreased due to a reduction in pressure over the wound, independent of the graft length and thickness. However, it may also be the reason for impaired functions (eating, speaking), psychological well-being (stress) and social well-being (socializing, daily/work routines). In a study by Keceli et al., the application of medicinal plant extract (MPE) accelerated the healing rate of the donor site and decreased postoperative discomfort of the FGG-harvested patients.¹¹

Apart from the method of protecting the palate wound, patients' postoperative sensations can also be influenced by the technique of graft collection itself and by the type of prepared grafts.^{2,19,26,27} In their study, Zucchelli et al. compared patients' feelings depending on whether the transplant was obtained by the trap-door approach or from the deepithelialization of a FGG.² No differences were observed in the amount of painkillers taken, discomfort or postoperative bleeding. The trap-door transplantation was associated with lower patient's stress and better ability to chew. The pain grew together with an increasing height of the graft and with a reduced thickness of the soft tissue still covering the palatal bone. The height and depth of the withdrawal and not the type of palatal wound healing (primary vs secondary) influenced the postoperative pain. A possible explanation is that by inserting the blade into the depth of the palatal soft tissue and/or toward the palatal vault (the height of the withdrawal), the probability of severing a large-sized nerve/vessel increases, causing greater pain. Moreover, greater analgesic consumption was reported by patient's experiencing primary flap dehiscence/necrosis.² In our study, the height of all harvested FGGs reached 5 mm, hence the effects of the height of the withdrawal on patient's morbidity cannot be evaluated. Nevertheless, there was no statistically significant difference between L1, L2 and L3 in terms of overall discomfort in the questioned area as well as between T1 and T2. Generally, the thicker and the longer the graft, the more problems occurred in most

assessed issues; however, the differences were small. This may implicate a helpful clinical hint during treatment planning when harvesting of a long and/or a thick graft is required.

Our study has some limitations that have to be addressed. An interpretation of the results of studies assessing the subjective feelings of patients should be very careful. The larger the studied population, the easier it is to analyze the results obtained. Our study included 60 patients divided into 3 groups, 20 patients in each group, depending on the FGG length (L1, L2 and L3) and 2 groups, 30 patients in each group, depending on the FGG thickness (T1 and T2). A lack of statistical significance between the groups evaluated does not mean that there exists equality between different graft lengths and thicknesses. Certainly, similar studies should be conducted on a larger sample of patients. In all patients, the palate treatment sites were secured with collagen sponges and individual palatine stents. This procedure also affects the patient's reported morbidity. The stents act as dressings, thereby reducing pain, discomfort and bleeding, but may impede speaking, eating and socializing.^{4,5,11,20,23} It would be worthwhile to evaluate the feelings of patients in whom stents were not used, since the symptoms could be more associated with the geometry of the graft. Thirdly, in this study, grafts were prepared for soft tissue augmentation in patients with thin biotype, for widening the narrowed zone of the callused gingiva and for gingival recession coverage.^{1,6,8} The method and extent of preparation of the donor site was different depending on the technique and treatment indications, which could also be reflected in the patients' reported reactions.^{6,8-10,21} Nevertheless, the analyzed questions were explained to be related only to the treatment area on the palate, and the patients completed a questionnaire in the presence of a physician who provided assistance in case of interpretation difficulties.

Conclusions

Understanding which factors might affect the level of discomfort (morbidity) that patients are likely to experience and oral health-related quality of life outcomes in general is crucial. The majority of the parameters analyzed in our study were calculated with no statistical significance, which does not necessarily mean that there exists an equivalence between different graft dimensions. However, within the limitations of our study, it may be speculated that the correlations between postoperative morbidity and the graft size lose value when the palatal wound is covered by an individual stent. This implicates a valuable clinical conclusion in the case of treatment planning and while explaining the procedure to a patient in order to lower their anxiety before a procedure that requires harvesting of a long and/or a thick graft.

References

- Kim DM, Neiva R. Periodontal soft tissue non-root coverage procedures: A systematic review from the AAP Regeneration Workshop. *J Periodontol*. 2015;86(Suppl 2):56–72.
- Zucchelli G, Mele M, Stefanini M, et al. Patient morbidity and root coverage outcome after subepithelial connective tissue and deepithelialized grafts: A comparative randomized-controlled clinical trial. *J Clin Periodontol*. 2010;37:728–738.
- Sullivan HC, Atkins JH. Free autogenous gingival grafts. I. Principles of successful grafting. *Periodont*. 1968;6:121–129.
- Hürzeler MB, Weng D. A single-incision technique to harvest subepithelial connective tissue grafts from the palate. *Int J Periodontics Restorative Dent*. 1999;19:279–287.
- Lorenzana ER, Allen EP. The single-incision palatal harvest technique: A strategy for esthetics and patient comfort. *Int J Periodontics Restorative Dent*. 2000;20:297–305.
- Zucchelli G, Mounssif I. Periodontal plastic surgery. *Periodontol*. 2015;68:333–368.
- Bosco AF, Bosco JM. An alternative technique to the harvesting of a connective tissue graft from a thin palate: Enhanced wound healing. *Int J Periodontics Restorative Dent*. 2007;27:133–139.
- Chambrone L, Tatakis DN. Periodontal soft tissue root coverage procedures: A systematic review from the AAP Regeneration Workshop. *J Periodontol*. 2015;86(Suppl 2):8–51.
- Haghighati F, Mousavi M, Moslemi N, Kebria MM, Golestan B. A comparative study of two root-coverage techniques with regard to interdental papilla dimension as a prognostic factor. *Int J Periodontics Restorative Dent*. 2009;29:179–189.
- Kerner S, Sarfati A, Katsahian S, et al. Qualitative cosmetic evaluation after root-coverage procedures. *J Periodontol*. 2009;80:41–47.
- Keceli HG, Aylikci BU, Koseoglu S, Dolgun A. Evaluation of palatal donor site haemostasis and wound healing after free gingival graft surgery. *J Clin Periodontol*. 2015;42:582–589.
- Inglehart MR. Enhancing periodontal health through regenerative approaches: A commentary on the need for patient-reported outcomes. *J Periodontol*. 2015;86 (Suppl 2):4–7.
- O'Leary TJ, Drake RB, Naylor JE. The plaque control record. *J Periodontol*. 1972;43:38. doi: 10.1902/jop.1972.43.1.38
- Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. *Int Dent J*. 1975;25:229–235.
- Miller PD Jr. A classification of marginal tissue recession. *Int J Periodontics Restorative Dent*. 1985;5:8–13.
- McCormack HM, Horne DJ, Sheather S. Clinical applications of visual analogue scales: A critical review. *Psychol Med*. 1988;18:1007–1019.
- R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria, 2016. <https://www.r-project.org/>. Accessed January 15, 2018.
- Zucchelli G, De Sanctis M. Modified two-stage procedures for the treatment of gingival recession. *Eur J Esthet Dent*. 2013;8:24–42.
- Del Pizzo M, Modica F, Bethaz N, Priotto P, Romagnoli R. The connective tissue graft: A comparative clinical evaluation of wound healing at the palatal donor site. A preliminary study. *J Clin Periodontol*. 2002;29:848–854.
- Farnoush A. Techniques for the protection and coverage of the donor sites in free soft tissue grafts. *J Periodontol*. 1978;49:403–405.
- Wessel JR, Tatakis DN. Patient outcomes following subepithelial connective tissue graft and free gingival graft procedures. *J Periodontol*. 2008;79:425–430.
- 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.
- Eltas A, Eltas SD, Uslu MO, Ersöz M. Evaluation of patient discomfort at the palatal donor site following free gingival graft procedures: A randomized controlled clinical trial. *J Periodontol Implant Dent*. 2014;6:47–53.
- Yıldırım S, Özener HÖ, Doğan B, Kuru B. Effect of topically-applied hyaluronic-acid on pain and palatal epithelial wound healing: An examiner-blind, randomized, controlled clinical trial. *J Periodontol*. 2017;88:1–14.
- Ozcan M, Ucak O, Alkaya B, Keceli S, Seydaoglu G, Haytac MC. Effects of platelet-rich fibrin on palatal wound healing after free gingival graft harvesting: A comparative randomized controlled clinical trial. *Int J Periodontics Restorative Dent*. 2017;37:270–278.
- Pandit N, Khana M, Gujnani S, Malik R, Bali D. Comparison of two techniques of harvesting connective tissue and its effects on healing pattern at palate and recession coverage at recipient site. *Contemp Clin Dent*. 2016;7:3–10.
- Rossi R, Pilloni A, Morales RS. Qualitative assessment of connective tissue graft with epithelial component. A microsurgical periodontal plastic surgical technique for soft tissue esthetics. *Eur J Esthet Dent*. 2009;4:118–128.