

A new technique for peri-implant recession treatment: Partially epithelialized connective tissue grafts. Description of the technique and preliminary results of a case series

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Abstract

Background: Data on implant recession coverage (RC) are very scarce.

Purpose: To present a new surgical approach and preliminary results for the treatment of peri-implant soft tissue recession via partially epithelialized connective tissue grafts (PECTGs).

Materials and Methods: We harvested PECTGs from the palate using a double-blade scalpel. All donor sites were sutured and covered with a stent. Dissection lines were placed minimally coronal to the mucogingival border. The recipient areas were prepared eperiostally. All PECTGs were sutured with the keratinized mucosa (KM) portion toward the local KM tissue and were subsequently widely covered by the local mucosal tissue layer.

Results: Fifteen patients with 22 implants were available for follow-up. The recession depth at baseline was 2.4 ± 1.1 mm (median: 2.5). After a mean observational period of 5 years, we found a mean recession value of 0.4 ± 0.5 mm (median: 0). We found a mean increase in the peri-implant KM width of 2.2 ± 1.1 mm (median: 1.5). In all cases, progression of the recession had stopped. None of the grafts was lost. The mean RC was 2 ± 0.9 mm (median: 1.5 mm) [$88 \pm 20\%$ (median: 100)]. Complete RC was found in 64% of the implants. The results have remained stable for up to 13 years.

Conclusion: Soft tissue recession around dental implants may successfully be treated using the PECTG technique.

1 | INTRODUCTION

Gingival recession around natural teeth is commonly found in adult patients, with a prevalence of 60% to 90% in western societies.^{1,2} A review and meta-analysis revealed that even under conditions of good oral hygiene, 78% of untreated recession cases showed defect progression.³ Different risk factors for the development of gingival recession have been discussed (ie, poor plaque control, thin buccal tissue dimensions, insufficient keratinized mucosa width [KMW], and

toothbrushing).⁴ Numerous surgical techniques for treating recession treatment have been proposed. Today, the combination of a coronally advanced flap and a connective tissue graft (CAF + CTG) is widely considered the most reliable procedure for root coverage in cases of single and multiple sites of recession.^{5,6} However, data concerning the long-term (>5 years) stability of root coverage procedures are scarce. Currently, data on the prevalence and dimensions of mucosal recession sites around dental implants can hardly be found. A systematic review of the frequency of advanced recession following single

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immediate implant treatment revealed only four studies providing data on mucosal recession, with the rate of peri-implant mucosal recession ranging from 0% to 64%.⁷ Recently, soft tissue dehiscence was defined as an apical shift of the peri-implant soft tissue margin with respect to the gingival margin of the homologous adjacent or contralateral tooth.⁸ The presence of recession may compromise adequate peri-implant hygiene measures, which might facilitate the onset of mucositis and peri-implantitis. Furthermore, the aesthetic outcome may be affected. Hence, there is a need to develop surgical procedures to recover sites of peri-implant mucosal recession with a high predictability. Different techniques to cover peri-implant recession sites have been proposed, including CAF + CTG,^{9,10} split thickness flap (STF) + CTG,¹¹ and STF + xenogeneic graft material.¹² The present study reports for the first time the outcome of a new technique for peri-implant recession coverage (RC) using a modified type of graft, that is, partially epithelialized connective tissue grafts (PECTGs). PECTGs mostly consist of connective tissue with a defined thickness and a band of KM on the surface.

2 | MATERIALS AND METHODS

This retrospective clinical case series was conducted in a private practice specializing in dental implant therapy (Northern Hessian Implant Center, Hofgeismar, Germany). A retrospective non-interventional study design was used based on an analysis of primary patient data that had been extracted from the patients' records. We evaluated the clinical outcomes of implants in patients who had undergone surgical soft tissue augmentation therapy via PECTGs for the treatment of peri-implant soft tissue recession. This study was prepared in compliance with the EQUATOR (STROBE) guidelines.

2.1 | Study population

In our center, patients who had undergone peri-implant soft tissue augmentation surgery with PECTGs for recession therapy were identified. These patients were approached and asked to participate in the study after having received written information regarding the aims and course of the investigation. Patients who provided written informed consent and met the following inclusion criteria were included:

- Age ≥ 18 years.
- Received peri-implant PECTGs surgery for peri-implant recession treatment at the study center.
- Observational period after surgery >6 months.
- Availability of the complete medical history, including the following potential risk factors: medications (immunosuppressive drugs and bisphosphonates), diabetes, cardiovascular disease, rheumatoid arthritis, and smoking habits.
- Participation in supportive implant therapy (SIT) in the study center.

The following exclusion criteria were applied:

- Presence of a positive risk factor.
- Referred patients.
- Patients noncompliant with SIT.

2.2 | Treatment course

All patients diagnosed with peri-implant soft tissue recession went through a preoperative implant cleaning. Thereafter, they underwent peri-implant KM augmentation surgery via the PECTG technique,¹³ which is able to provide KM and simultaneously considerably increase the mucosal thickness. After wound healing, all patients were advised to participate in a SIT program.

2.3 | Surgical technique

In 1992, Harris¹⁴ proposed a surgical approach for harvesting CTGs from the palate using a double-blade scalpel. These grafts were used for root coverage procedures for natural teeth and yielded very good results.¹⁵ We used this double-blade scalpel to perform a different technique for harvesting soft tissue grafts from the palate. With a minimal distance of 2 mm to the gingival margin, two parallel incisions were made to a depth of approximately 10 mm. With a single-blade scalpel, the graft was then dissected at the mesial, distal, and apical edges without removing the epithelium on top of the graft (Figure 1A-C). The donor area is sutured and covered with a previously fabricated stent (Erkodent, 1.5 mm, Erkodent GmbH, Pfalzgrafenweiler, Germany) to facilitate wound healing.

Before surgery, all implants were cleaned using polishing paste and a rubber cup. At the site of the affected implant, an STF was raised and reflected (Figure 2A, B). After harvesting a PECTG (Figure 2C,D), it was trimmed and sutured with its KM portion toward the local KM tissue (Figure 2E,F). In the following step, the connective tissue portion of the PECTGs was covered by the mucosal flap (Figure 2G). Postoperatively, patients were provided with analgesics (ibuprofen 400 mg) and advised to rinse with chlorhexidine 0.2% for up to 4 weeks. The stent was left in place for 48 hours at the donor site and thereafter applied during meals and at night for five additional days. Sutures could normally be removed after 10 days.

2.4 | Data collection

All patients were provided with a detailed description of the study. In addition, they were informed about the statistical use of their data before they provided their informed consent. Between 1 April 2018 and 1 April 2018, the patients in our study were evaluated according to the following parameters using patient records: age, sex, medical history, smoking habits, anatomical implant position (according to the

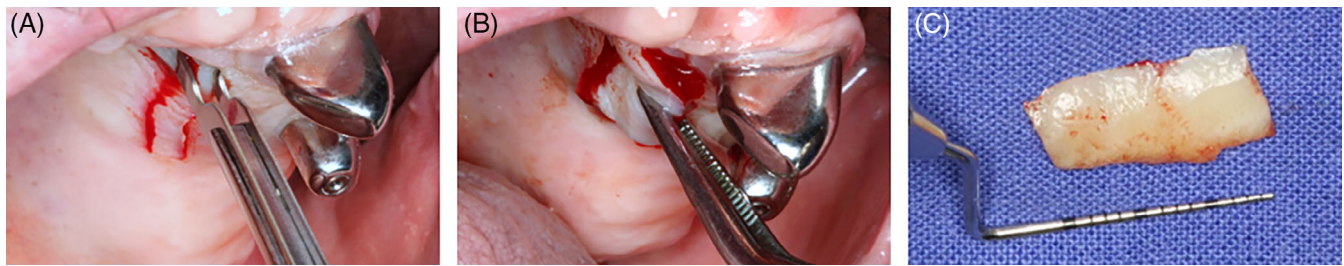


FIGURE 1 A-C: PECTGs harvest from the palate: After preparation with a double-blade scalpel A, the graft is dissected with a single-blade scalpel (15C blade) and can be removed. B, The resulting graft has a consistent connective tissue thickness. C, and the KM portion is left on the surface. KM, keratinized mucosa; PECTGs, partially epithelialized connective tissue grafts

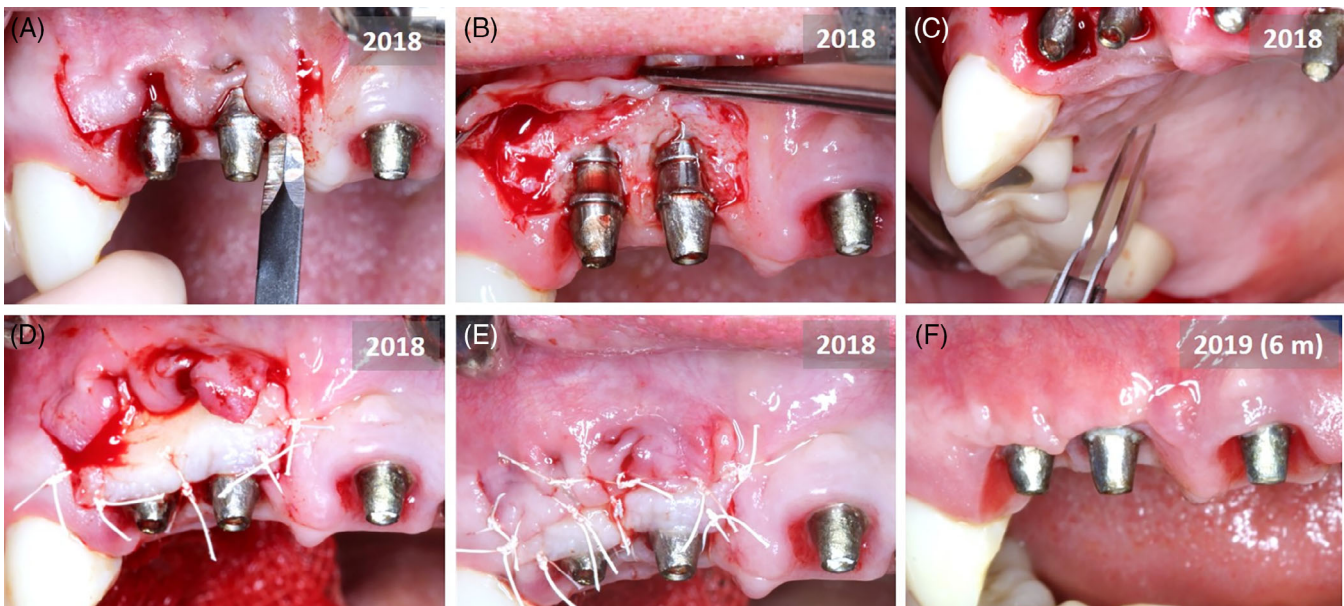


FIGURE 2 A-F: After 6 years of intraoral service, two implants in the maxillary esthetic zone showed buccal recession up to 3.5 mm but no signs of peri-implant inflammation A, A mucosal flap was raised. B, PECTGs were harvested from the palate. C, It was trimmed and sutured with the KM portion toward the local keratinized tissue. D, Then, it was covered widely by the mucosal flap. E, After 6 months, the buccal tissue showed a considerable thickness gain. F, The recession sites were largely covered. KM, keratinized mucosa; PECTGs, partially epithelialized connective tissue grafts

Federation Dentaire Internationale [FDI] scheme), implant loss, and observation period.

The peri-implant soft tissue recession was measured from the margin of the restoration to the tissue margin using a millimeter-scaled periodontal probe (PCP 15; Hu-Friedy, Chicago, Illinois). Numerical values were rounded to the nearest 0.5 mm.

3 | RESULTS

In this retrospective case series, 15 patients with 22 implants met the inclusion criteria (no cases of smoking or diabetes). The PECTG technique was suitable for the coverage of peri-implant soft tissue recession. In all cases, a significant increase in the buccal tissue thickness could be observed (Figure 1H). The PECTG

harvesting technique using a double-blade scalpel was not complex or time-consuming, and there were no relevant complications (ie, excessive palatal bleeding or pain). Palatal wound healing was always regular. No relevant necrosis was observed, and no grafts were lost. After 5 years, one implant had to be removed due to peri-implantitis.

At baseline, the peri-implant soft tissue recession depth (RD) ranged from 1 to 4 mm, with a mean value of 2.4. The final examinations were conducted after a mean observational period of 5 years and yielded a remaining RD ranging from 0 to 2.5 mm, with a mean value of 0.4. Therefore, the PECTG technique resulted in significant RC of 1 to 3.5 mm (mean: 2, or 88%). Complete RC was observed in 14 implants (64%). The KM width increased from a mean value of 0.25 to 2.45 mm. In 10 of the implants, the achieved soft tissue level remained stable for >5 years. The relevant data are presented in Table 1.

TABLE 1 Data on patients, observational period, REC, and KMW

n (patients)	Sex	Age	Site (FDI)	years in function	REC preop (mm)	REC postop (mm)	REC cover (mm)	REC cover (%)	KMW preop (mm)	KMW postop (mm)	KMW gain (mm)
1	M	65.3	13	4.2	3.5	2.5	1	28.6	0	1.5	1.5
2	F	63.5	11	4.6	2	0.5	1.5	75	0	1.5	1.5
			21	4.6	1	0	1	100	0.50	1.5	1
3	M	28.7	11	3.5	1.5	0	1.5	100	0	1.5	1.5
4	M	74.3	25	6.3	4	2.5	1.5	37.5	0	1	1
5	F	64.2	43	13.6	3	0.5	2.5	83.3	0	3	3
			33	13.6	3	0.5	2.5	83.3	0	3	3
6	M	76.7	26	5.2	3	1	2	66.7	0	1.5	1.5
7	F	48.6	23	1.9	3	0	3	100	0	3	3
			25	1.9	4	0	4	100	0	4	4
8	M	65.4	45	3.2	1.5	0	1.5	100	1.5	4	2.5
9	M	67.4	45	5.4	2.5	0	2.5	100	0	3	3
10	F	62.9	16	5	1	0	1	100	0	1	1
11	F	17.6	12	6.7	1	0	1	100	0	3	3
			13	6.7	1.5	0	1.5	100	1	5	4
			22	6.7	1	0	1	100	0	3	3
			23	6.7	1.5	0	1.5	100	1	5	4
12	F	56.7	34	2.5	3	0.5	2.5	83.3	0	1	1
13	F	53.6	11	0.7	4	0.5	3.5	87.5	0.5	2	1.5
			12	0.7	3.5	0	3.5	100	0.5	2	1.5
14	M	0.0	26	2	2.5	0	2.5	100	0.5	2	1.5
15	F	0.0	15	6	1	0	1	100	0	1.5	1.5
mean				5.09	2.36	0.39	1.98	88.42	0.25	2.45	2.20
median				4.82	2.5	0	1.5	100	0	2	1.5
SD				3.39	1.09	0.74	0.93	20.45	0.43	1.23	1.05
min/max				0.7/13.6	1/4	0/2.5	1/3.5	28/100	0/1.5	1/5	1/4

Abbreviations: FDI, Federation Dentaire Internationale; KMW, keratinized mucosa width; POSTOP, postoperative; PREOP, preoperative; REC, recession.

4 | DISCUSSION

In many cases of peri-implant mucosal recession, clinicians find two shortcomings: 1. insufficient KM dimensions; and 2. a very thin tissue layer at the buccal aspect. The PECTGs technique addresses both by the superior bilaminar nutrition of the CTG and the direct transplantation of KM (advantage of free gingival graft).

4.1 | Main results

This article describes the results achieved in 15 patients with 22 peri-implant recession sites treated with a novel surgical approach via PECTGs. After surgery, all implant sites exhibited obvious tissue thickening and a mean gain of 2.2 mm in the KM width (KMW). In all cases, a considerable reduction in the RD (mean: 2 mm) was found. The mean RC was 88%.

4.2 | Limitations

As this study comprised only 15 patients, the validity of the presented results is obviously limited. Consequently, these findings will have to be verified by other researchers and in different settings. The fact that only one experienced periodontal surgeon performed all treatment steps may represent another limitation. Furthermore, different recession dimensions (width and depth) and the thickness of the remaining tissue could not be included.

4.3 | Interpretation

In the literature, data on peri-implant RC are scarce. Only two studies have reported an observational period of 5 years.^{16,17} Burkhardt et al⁹ treated 10 patients with a mean RD of 3 (1.9–4.7) mm using CAF + CTG. After 6 months, a mean RC of 66% was reported. Zucchelli

et al¹⁰ reported on the treatment of 20 patients with peri-implant recession (mean RD: 3 mm). They underwent a comparably long (>9 months) and complex treatment plan (removal of prosthodontics crown, placement of a provisional crown, CAF + CTG, 8 months of healing, and placement of definitive restorations). After 5 years, a mean RC of 99.2% was found (79% of cases with complete RC). Rocuzzo et al¹⁶ conducted a study on 13 maxillary tissue level implants with recession treated using CAF + CTG from the maxillary tuberosity. After 5 years, the mean RD decreased from 1.9 (1-3) mm to 0.2 (0-0.5) mm. The mean RC was 86%, and complete coverage was found for 62% of the implants. The present study found RC and complete RC in 88% and 64% of all cases, respectively. Therefore, the RC results from PECTG treatment seem to be in accordance with the limited available data. However, it must be stated that the initial mean RD in our study was 2.4 mm compared to the previously reported values of 3¹⁰ and 1.9 mm.¹¹

The peri-implant keratinized tissue height (KTH) was not reported by Rocuzzo, while Zucchelli reported a median KTH of 1.75 mm at baseline and a mean gain of 0.57 mm after 1 year (0.5 mm after 5 years). Burkhardt et al⁹ found a KTH of 1.3 mm before the intervention and stated no relevant improvement after 1, 3, or 6 months. In contrast, the current study found a mean gain in the peri-implant KTH of 2.2 mm, starting with a mean value of 0.25 mm at baseline. This difference might be because a band of ~1.5 mm keratinized tissue is part of the PECTG.

Until now, whether a certain KMW is beneficial for dental implantation or a lack of KMW could negatively influence peri-implant tissue health has been discussed controversially. While some early studies showed that implants without KMW can be maintained and remain healthy, significant correlations between the survival/success rate of the dental implants and the presence of KMW could not be confirmed.¹⁸⁻²⁰ However, in clinical reality, it seems to be difficult to achieve sufficient plaque control around implants without KMW.^{21,22} More recent studies have indicated that implants with a KMW <2 mm seem to be more prone to peri-implant bleeding, bone loss and mucosal recession.²³⁻²⁸ A systematic review and meta-analysis revealed that implants without an adequate KMW were associated with more plaque, signs of inflammation, mucosal recession, and attachment loss.²⁹ These findings were confirmed by a systematic review that found correlations between an adequate KMW and peri-implant tissue health.³⁰ In addition, insufficient mucosal thickness has been discussed as a risk factor for peri-implant mucosal recession.^{31,32} Both risk factors, that is, inadequate KMW and mucosal thickness, can be addressed with the PECTG technique.

5 | CONCLUSION

Clinicians might use the PECTG technique as an applicable option for the treatment of peri-implant soft tissue recession. A significant gain in the KMW and mucosal thickness can be achieved. Further research is needed to verify our results and to compare the PECTG technique with other suggested treatments.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

AUTHOR CONTRIBUTIONS

Petra Ratka-Krüger and Eberhard Frisch conceived the concept of the study; Eberhard Frisch collected the data; Petra Ratka-Krüger and Eberhard Frisch analyzed the data; and Eberhard Frisch and Petra Ratka-Krüger led the writing.

ETHICS STATEMENT

This study was reviewed and authorized by the Ethics Commission of the Albert-Ludwigs University Freiburg, Germany (application no. 10008/19).

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