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Long-Term 8-Year Outcomes of Coronally Advanced Flap for Root Coverage

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Background: This long-term 8-year case series study aims at evaluating the results of the outcomes of coronally advanced flap (CAF) procedures performed for the treatment of single gingival recessions (GRs).

Methods: Sixty patients with single maxillary GRs ≥2 mm, without loss of interproximal soft and hard tissue, treated with the CAF procedure and evaluated at 6 months in a previously published article, were followed for 8 years. Complete root coverage, recession reduction, and amount of keratinized tissue (KT) were analyzed using descriptive statistics, the paired *t* test, McNemar test, and a general linear model.

Results: Three patients dropped out during the course of 8 years. Recession reduction from baseline to 8 years was 2.3 ± 1.1 mm; $P < 0.0001$, whereas GRs increased in 53% of the sites from 6 months to 8 years (0.5 ± 0.7 mm; $P < 0.0001$). The percentage of sites with complete root coverage decreased from 55% at 6 months to 35% at 8 years ($P = 0.0047$). The amount of KT tended to decrease from baseline to 8 years (0.6 ± 0.8 mm; $P < 0.0001$). The general linear model shows that recession reduction is associated with both baseline recession depth and with the amount of initial KT. Sex, age, and smoking are not associated with recession reduction at 8 years.

Conclusions: The CAF procedure is effective in the treatment of GRs However, recession relapse and reduction of KT occurred during the follow-up period. The baseline width of KT is a predictive factor for recession reduction when using the CAF technique. *J Periodontol 2012;83:590-594.*

KEY WORDS

Gingival recession; long-term care; surgical flap.

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A large number of sound clinical trials demonstrate the efficacy of coronally advanced flap (CAF)-based procedures for the treatment of single and multiple gingival recessions (GRs).[1,2] However, little information is available on the long-term results of this approach.

A case series study on a modified CAF procedure on single-recession defects[3] reported substantial stability of outcomes associated with a significant increase in keratinized tissue (KT) at 3 years (96.7% average root coverage) with respect to 1 year (98.6%). Leknes et al.[4] reported recurrences of GR in a 6-year long-term study in sites treated with either CAF or barrier membranes. Seven of 11 CAF-treated sites showed an apical displacement of the gingival margin (GM).

A recent 14-year long-term randomized study[5] on single recessions reported an apical shift of the GM (recession relapse) in 39% of the sites treated with CAF. This evidence on single recessions treated with CAF seems to indicate a tendency to recurrences that becomes more evident with time. The same trend has also been noted after CAF procedures performed for multiple recessions. In fact, a 5-year long-term evaluation of a case series treated with the envelope-type CAF on multiple recessions reported a slight apical shift of the GM compared to 1 year.[6] The 88% complete root coverage (CRC) observed at 1 year decreased to 85% at

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Table 1.

Descriptive Statistics: Variables During the 8-year Follow-Up Period

Periodontal Measurements	Baseline (60 Patients)	6 Months (60 Patients)	1 Year (60 Patients)	5 Years (59 Patients)	8 Years (57 Patients)
REC (mm)	3.2 ± 1.1	0.3 ± 0.5	0.5 ± 0.5	0.7 ± 0.7	0.9 ± 0.9
KT (mm)	2.7 ± 1.1	2.4 ± 0.9	2.3 ± 1.0	2.3 ± 1.1	2.2 ± 1.2
PD (mm)	1.1 ± 0.4	0.8 ± 0.3	0.8 ± 0.3	0.8 ± 0.3	0.8 ± 0.4
CRC (%)	—	33 (55)	27 (45)	21 (36)	20 (35)
DH (%)	33 (55)	11 (18)	9 (15)	7 (12)	10 (18)

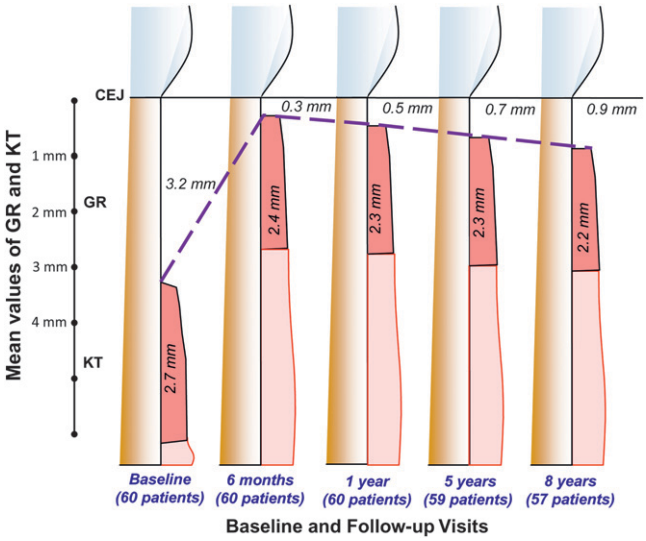

Figure 1.
Mean values of gingival REC and KT at baseline and follow-up.

5 years. This tendency was confirmed by a recent long-term comparative study[7] on multiple recessions treated with CAF alone or with connective tissue graft (CTG). The authors reported a significant apical shift of the GM at 5 years in the CAF-treated sites, whereas the CAF/CTG-treated sites showed a tendency to a coronal shift of the GM. In other words, the use of a graft under a flap prevented the recurrence of the recessions.

A large case cohort study[8] of 60 patients with single GRs treated with CAF reported CRC in 33 sites (55%) with a mean recession reduction of 2.86 ± 0.99 mm, associated with a 0.37-mm reduction of the amount KT from baseline and an 0.82-mm apical shift of the mucogingival junction (MGJ) with respect to the post-operative position. This study demonstrated that the postoperative location of the GM, relative to the cemento-enamel junction (CEJ), influenced the probability of CRC: the more coronal the GM after suturing, the greater the probability of achieving CRC, at 6 months. The described patient population was followed up for 8 years.

The aim of the present study is to evaluate the long-term outcomes of CAF performed for the treatment of single GRs in a population of 60 patients.

MATERIALS AND METHODS

Study Population

The study population consisted of a group of 60 patients included in a previous short-term clinical trial, in which single recessions were treated with CAF.[8] The main goal of the original study is to investigate the role of the post-surgical position of the GM on root coverage.[8] The study protocol was approved by the internal ethics committee, Department of Odontostomatology, University of Florence, Florence, Italy. The patients agreed to participate in this study and gave written informed consent.

The baseline entry criteria included the following: 1) non-compromised systemic health and no contraindications for periodontal surgery; 2) presence of one maxillary buccal recession ≥2 mm (classified as Miller's Class I or II[9]); 3) recession-associated dental hypersensitivity (DH) or impaired esthetics; 4) the presence of identifiable CEJ; 5) tooth vitality and absence of grooves, irregularities, caries, or restorations in the area to be treated; 6) no periodontal surgical treatment during the previous 24 months on the involved sites; 7) full-mouth plaque score (FMPS) <20% and full-mouth bleeding score <20%; and 8) absence of plaque and bleeding on probing at the selected sites.

At baseline, one investigator (PC) took the following measurements using a periodontal probe[‡]: recession depth (REC) and probing depth (PD) at the mid-buccal site; KT width as the distance between the GM and the MGJ; clinical attachment level (CAL) was calculated as PD + REC. DH was recorded as present or absent.

The patients were treated with the CAF performed by an operator (GP-P) different from the previous investigator. The surgical procedure was extensively described previously.[8]

‡ PCP-UNC 15 periodontal probe, Hu-Friedy, Chicago, IL.

Table 2.

GR and KT Differences During the Follow-Up Period (Paired *t* Test)

Follow-Up Period	REC Difference (mm)	REC; 95% CI	REC *P* Value	KT Difference (mm)	KT; 95% CI	KT *P* Value
6 months versus 1 year	0.12	0.04; 0.19	0.0022	–0.07	–0.15; 0.00	0.0487
1 versus 5 years	0.23	0.12; 0.34	0.0001	–0.01	–0.09; 0.07	0.8369
5 versus 8 years	0.18	0.07; 0.28	0.0019	–0.10	–0.19; 0.00	0.0472

95% CI = 95% confidence interval.

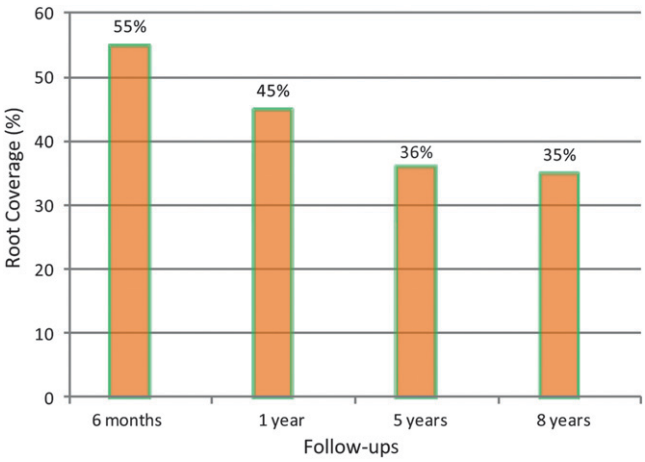

Figure 2.
Percentage of CRC at 6-months, 1-year, 5-years, and 8-years follow-up.

The baseline measurements were repeated, and root coverage was assessed 6 months after surgery.

Follow-Up at 6 Months to 8 Years

All the patients complied with a program of supporting periodontal care based on a 6-month recall system for professional prophylaxis and reinstruction in tooth-brushing maneuvers, all done by the same dental hygienist (DF).

The periodontal measurements (REC, PD, CAL, KT, and DH) recorded at 6 months were repeated at 1, 5, and 8 years, using the same periodontal probes as at baseline. CRC was also assessed.

Statistical Analysis

Quantitative data were summarized as mean ± SD, and qualitative data were summarized as frequency (%). Paired *t* tests were used to evaluate recession reduction and KT variations. The McNemar test was performed to evaluate differences in CRC and DH between 6 months and 8 years.

A prognostic general linear model was set up using recession reduction between baseline and 8 years as the outcome variable and baseline REC, baseline KT, sex, age, and smoking as the explicative variables.

RESULTS

The original study population consisted of 15 males (25%) and 45 females (75%), 11 smokers, with a mean age of 29.7 ± 6.0 years at baseline. Five maxillary central incisors (8%), four maxillary lateral incisors (7%), 34 maxillary canines (57%), 16 maxillary first premolars (27%), and one maxillary second premolar (2%) were treated.

Three patients dropped out of the study (one at 5 years and two at 8 years) because they moved to another country. FMPS was <20% during the follow-up period.

Data from baseline through the 8-year follow-up visit are shown in Table 1.

REC

GR decreased (2.3 ± 1.1 mm) from baseline to 8 years, showing the effectiveness of CAF for the treatment of exposed root surfaces (Fig. 1).

However, a significant increase of REC (mean of 0.5 ± 0.7 mm) occurred from 6 months to 8 years. The differences between 6 months and 1 year, 1 and 5 years, and 5 and 8 years are all statistically significant (Table 2). In particular, from 6 months to 8 years, 30 sites (53%) showed an increased REC, whereas 24 sites remained stable (42%). Only three sites showed an additional recession reduction (5%).

CRC

The percentage of sites with CRC decreased from 6 months to 8 years ($P = 0.0047$) (Fig. 2). In particular, 15 sites with CRC at 6 months showed a recurrent recession at 8 years, whereas three patients with residual recession at 6 months showed CRC at 8 years.

During the follow-up observation period, recession tended to increase (mean of 0.5 ± 0.7 mm) in both groups of sites that had achieved complete CRC or partial root coverage at 6 months.

DH

The difference in the decrease of DH from baseline to 8 years (Table 1) is statistically significant ($P<0.0001$). At baseline, 33 sites had DH, but 25 of those sites had no DH at 8 years, whereas four sites did not show DH at baseline but developed DH at 8 years. Two patients showing DH at baseline dropped out.

KT

The amount of KT tended to decrease from baseline to 8 years (–0.6 ± 0.8 mm) (Fig. 1). The differences between 6 months and 1 year, 1 and 5 years, and 5 and 8 years are given in Table 2.

General Linear Model

The general linear model shows that recession reduction is associated with the amount of baseline KT; every millimeter of additional KT at baseline is associated with an increment of 0.23 mm of recession reduction at the 8-year follow-up visit. Recession reduction is also associated with baseline REC: the greater the recession at baseline, the lower the recession reduction after 8 years. Sex, age, and smoking were not associated with recession reduction at 8 years (Table 3).

DISCUSSION

The CAF technique is considered a reliable approach for root coverage when treating single GR and multiple recessions in short/middle follow-up periods. Several factors, such as flap thickness,[10] flap tension,[11] position of the GM,[8] height of interdental papilla,[12] and baseline REC,[13] may influence the final outcomes of this procedure. However, there is little information on long-term results. The aim of the present study is to evaluate the long-term outcomes of CAF performed for the treatment of single GRs in 60 patients followed for 8 years. The results confirm that the CAF procedure is effective in the treatment of GR. However, a recurrence of recession occurred in 53% of treated sites over time (Fig. 3).

It should also be emphasized that all patients were compliant and showed a high level of oral hygiene (FMPS <20%). The observed relapse of the soft-tissue defects could be attributable to a resumption of traumatic toothbrushing habits in patients with high levels of oral hygiene even if they were included in a stringent maintenance protocol with recalls every 6 months.

Table 3.

General Linear Model

Term	Estimate	Standard Error	*P* value
Intercept	–0.14	0.76	
Baseline REC	0.73	0.11	<0.0001
Baseline KT	0.23	0.11	0.0373
Sex	0.02	0.13	0.8607
Age	–0.02	0.02	0.3565
Smoking	0.01	0.14	0.9511

Recession reduction from baseline to 8 years is the outcome variable (R^2 = 0.49).

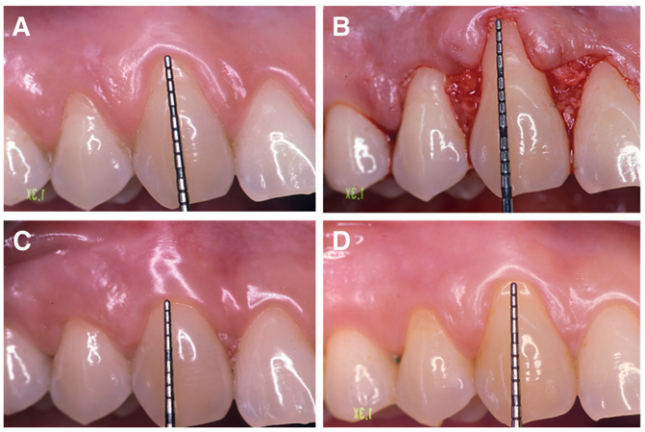

Figure 3.
A) *GR (2 mm) on the right upper cuspid (patient 14).* ***B)*** *CAF is elevated.* ***C)*** *CRC is achieved 6 months post-surgery.* ***D)*** *GR recurrence (2 mm) is evident after 8 to 10 years.*

These results agree with the conclusion of the study by Leknes et al.[4] showing a lack of stability of the GM of single recessions treated with CAF after 6 years. Similar conclusions were obtained in a recent long-term randomized clinical study[5] performed on single GRs treated with CAF technique that revealed an apical shift of the GM in ≈39% of the treated sites with a progressive worsening of the GRs during the 14-year follow-up period. The estimated average apical shift was 0.024 mm/year.

Regarding KT width, the results of this study showed that it tends to decrease over time. These outcomes were different from those reported in previous studies[6,14] in which the amount of KT increased after 1 and 5 years.

An interesting clinical consideration can be inferred from the general linear model. The baseline amount of KT is a prognostic factor for recession reduction; in fact, every additional millimeter of KT at baseline provides 0.23 mm of greater recession reduction after 8 years.

CONCLUSIONS

In conclusion, this long-term case series study shows the following: 1) CAF approach is effective in the treatment of single GR; 2) apical shift of the GM occurs in 53% of the cases and is associated with a reduction of KT; and 3) baseline amount of KT is a prognostic factor for recession reduction: the greater the width of KT, the greater the reduction of the recession.

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The authors report no conflicts of interest related to this case series study.

REFERENCES

1. Cairo F, Pagliaro U, Nieri M. Treatment of gingival recession with coronally advanced flap procedures: A systematic review. *J Clin Periodontol* 2008; 35(Suppl. 8):136-162.
2. Chambrone L, Sukekava F, Araújo MG, Pustiglioni FE, Chambrone LA, Lima LA. Root-coverage procedures for the treatment of localized recession-type defects: A Cochrane systematic review. *J Periodontol* 2010;81: 452-478.
3. de Sanctis M, Zucchelli G. Coronally advanced flap: A modified surgical approach for isolated recession-type defects: Three-year results. *J Clin Periodontol* 2007; 34:262-268.
4. Leknes KN, Amarante ES, Price DE, Bøe OE, Skavland RJ, Lie T. Coronally positioned flap procedures with or without a biodegradable membrane in the treatment of human gingival recession. A 6-year follow-up study. *J Clin Periodontol* 2005;32:518-529.
5. Pini Prato G, Rotundo R, Franceschi D, Cairo F, Cortellini P, Nieri M. Fourteen-year outcomes of coronally advanced flap for root coverage: Follow-up from a randomized trial. *J Clin Periodontol* 2011;38: 715-720.
6. Zucchelli G, De Sanctis M. Long-term outcome following treatment of multiple Miller class I and II recession defects in esthetic areas of the mouth. *J Periodontol* 2005;76:2286-2292.
7. Pini-Prato GP, Cairo F, Nieri M, Franceschi D, Rotundo R, Cortellini P. Coronally advanced flap versus connective tissue graft in the treatment of multiple gingival recessions: A split-mouth study with a 5-year follow-up. *J Clin Periodontol* 2010;37:644-650.
8. Pini Prato GP, Baldi C, Nieri M, et al. Coronally advanced flap: The post-surgical position of the gingival margin is an important factor for achieving complete root coverage. *J Periodontol* 2005;76:713-722.
9. Miller PD Jr. A classification of marginal tissue recession. *Int J Periodontics Restorative Dent* 1985;5(2): 8-13.
10. Baldi C, Pini-Prato GP, Pagliaro U, et al. Coronally advanced flap procedure for root coverage. Is flap thickness a relevant predictor to achieve root coverage? A 19-case series. *J Periodontol* 1999;70:1077-1084.
11. Pini Prato G, Pagliaro U, Baldi C, et al. Coronally advanced flap procedure for root coverage. Flap with tension versus flap without tension: A randomized controlled clinical study. *J Periodontol* 2000;71:188-201.
12. Saletta D, Pini Prato G, Pagliaro U, Baldi C, Mauri M, Nieri M. Coronally advanced flap procedure: Is the interdental papilla a prognostic factor for root coverage? *J Periodontol* 2001;72:760-766.
13. Nieri M, Rotundo R, Franceschi D, Cairo F, Cortellini P, Pini Prato G. Factors affecting the outcome of the coronally advanced flap procedure: A Bayesian network analysis. *J Periodontol* 2009;80:405-410.
14. Zucchelli G, Mele M, Mazzotti C, Marzadori M, Montebugnoli L, De Sanctis M. Coronally advanced flap with and without vertical releasing incisions for the treatment of multiple gingival recessions: A comparative controlled randomized clinical trial. *J Periodontol* 2009;80:1083-1094.

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