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# Efficacy of Coronally Advanced Flap with and Without Augmentation in The Management of Gingival Recession: A Systematic Review

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## ABSTRACT

**Background and Objectives:** An array of therapeutic options are available for the management of gingival recession by utilizing pedicle flap procedures or by free soft tissue graft procedures. Coronally Advanced flaps have been described to maintain the recipient site esthetics and to prevent the relapse of recession. Hence, a newer approach using Coronally Advanced Flap with or without adjunctive augmentation to gain more potential results for Gingival Recession. This study aimed to systematically gather and evaluate the efficacy of Coronally Advanced Flap technique Flap with or without adjunctive augmentation techniques in the treatment of gingival recession.

**Data Sources:** The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline for systematic reviews were used. A systematic search was conducted using MEDLINE, Cochrane Central Register of Controlled Trials, Google Scholar, Google, Clinical trials registry and manual search using D.Y. Patil Dental College library resources were searched up to and including 31st October 2019 to identify appropriate studies. All cross-reference lists of the selected studies were also screened.

**Results:** After a literature search of 368 articles from PubMed, 8 articles were found relevant according to the inclusion criteria which evaluated the efficacy of Coronally advanced flap with or without adjunctive augmentation technique in the management of gingival recession defects, where Coronally Advanced Flap with Augmentation showed better results as compared to Coronally Advanced Flap alone.

**Conclusion:** Coronally Advanced Flap Technique with the use of various augmentation is effective in the management of gingival recession.

**Key Words:** Millers Class I Recession, Millers Class II Recession, Isolated Recession, RecessionCoverage, Root Coverage, Coronally Advanced Flap, Connective Tissue Graft, Platelet Rich Fibrin, Enamel Matrix Derivative, Collagen Membrane, Placental Membrane

## INTRODUCTION

The fundamental goal of periodontal care is to improve oral health, by re-establishing comfort, function and esthetics of natural teeth. It involves the treatment of gingival recession (GR), which is characterized by the exposure of the root surface caused by the displacement of the gingival margin apical to the cemento-enamel junction (CEJ).<sup>1</sup> To avoid GR progression and its functional and esthetics consequences, various surgical techniques have been proposed to achieve predictable root coverage.<sup>2</sup> The most common etiological factors include periodontal disease, aggressive tooth brushing, aberrant frenal attachment, inflammation, improper

flossing, incorrect occlusal relationships, and dominant roots.<sup>3</sup> Numerous surgical approaches for the treatment of single Miller Class I and II gingival recession (GR) defects are documented in the literature.<sup>4</sup> One of the most reliable techniques that result in the best long term clinical outcome is the coronally advanced flap (CAF) procedure. This procedure may be used alone or in combination with connective tissue graft (CTG), barrier membrane, enamel matrix derivative, acellular dermal matrix, or platelet-rich plasma.<sup>5</sup>

A significant percentage of Gingival recession coverage has been showing by several preneoplastic techniques that include CAF Or CAF+CTG or different biomaterials. A

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study done by Jepsen, et al. showed increased mean root coverage, as well as higher predictability in achieving complete root coverage when compared to CAF alone.<sup>2</sup> One of these substitutes is a xenogeneic collagen matrix (CMX) of porcine origin that has been successfully used to augment keratinized tissue<sup>4</sup> and is less invasive, time-consuming, and unlimited supply.<sup>6</sup> The use of enamel matrix derivative proteins (EMD) in root coverage procedures has shown excellent clinical features as the improvement of the probability to achieve complete root coverage in localized Miller class I and II gingival recessions when compared to the CAF alone. Also, periodontal regeneration, as seen in histological studies in animals and humans with the formation of new bone, cementum, and the periodontal ligament is associated with EMD use.<sup>7</sup> Based on these biomaterials characteristics, it could be hypothesized that the association of CM and EMD would increase the predictability of the treatment of gingival recession defects.<sup>6</sup>

The amnion and chorion are membranes that build the amniotic sac that surrounds and protects an embryo. It has biological properties that can modulate angiogenesis, reduce inflammation, diminish the occurrence of adhesions and scarring, and promote wound healing.<sup>8</sup> Applications of placental allograft include the treatment of corneal epithelial defects, chemical or thermal burns, neurotrophic corneal ulcers, glaucoma surgery, cicatricial pemphigoid or Stevens-Johnson syndrome, and the reconstruction of conjunctival and ocular surfaces.<sup>9</sup> Placental membranes have recently been tried as a biomaterial for regenerative purposes. In periodontics, these membranes have also been used for the treatment of furcation defects, root coverage, and intrabody defects.

Systematic reviews aim to address these problems by identifying critically evaluating and integrating the finding of all relevant, high-quality individual studies addressing one or more research questions.

Thus, a systematic review summarizes the results of available carefully designed health care studies (Randomized Control Trials) and provides a high level of evidence on the effectiveness of health care interventions.

So far, no systematic review evaluating the efficacy of Coronally Advanced Flap alone and Coronally Advanced Flap with various Adjunctive like Connective Tissue Graft, Xenogenous Collagen Matrix, Enamel Matrix Derivative, Placental Membrane in the treatment of gingival recession defects has been performed. Hence, the study aims to gather and evaluate in a systematic manner available data on the efficacy of Coronally Advanced Flap with or without adjunctive augmentation techniques in the treatment of Gingival Recession.

## MATERIAL AND METHOD

### ELIGIBILITY CRITERIA

#### Inclusion Criteria :

1. Eligible studies included randomized clinical trials with essential data on Coronally Advanced Flap with and without Augmentation in Gingival Recession
2. Eligibility criteria were good health, any age groups and either sex, Gingival Recession subjects and Coronally Advanced Flap intervention with and without various Augmentation techniques.
3. Pubmed search which includes articles published from the earliest available data up to 31<sup>st</sup> November 2019.
4. Studies that include any two of the indices for the severity of Miller's Class I, Millers Class II Gingival Recession, isolated Gingival recession.
5. Only papers written in English were accepted

#### Exclusion Criteria:

1. Reviews, case reports, abstracts, editorials, letters, and historical reviews and in vitro studies and unpublished, grey literature was not included in the search.
2. Studies including medically compromised patients, smokers, pregnant women
3. Studies that have used Multiple Gingival Recession.

Studies including animal models.

### PICO

P - Participants: Gingival Recession patients

I - Intervention: Coronally Advanced Flap

C - Comparison: Coronally Advanced Flap + Connective Tissue Graft OR Coronally Advanced Flap + Platelet Rich Fibrin OR Coronally Advanced Flap + Enamel matrix Derivative OR Coronally Advanced Flap + collagen matrix, Coronally Advanced Flap + Placental Membrane.

O - Outcomes: Root Coverage.

S - Study designs: Randomized Clinical Trials.

A final of 8 articles have been used for detailed evaluation in this systematic review after assessment of the full text.

## RESULTS

After a literature search of 368 articles from PubMed, 8 articles were found relevant according to the inclusion criteria which evaluated the efficacy of Coronally advanced flap with or without adjunctive augmentation technique in the management of gingival recession defects, where Coronally Advanced Flap with Augmentation showed better results as compared to Coronally Advanced Flap alone.

## DISCUSSION

The gingival recession has been associated with dentinal hypersensitivity, root caries and esthetic Compromise. Several grafts have been used in different clinical trials with different degrees of success. literature indicates that the subepithelial connective tissue graft is the most predictable root coverage surgical procedure, considered as a 'gold standard' technique, in which a bilaminar vascular environment is created to nourish the graft.<sup>1</sup>

To increase the efficacy of root coverage procedures, reduce the morbidity of the technique, and improve clinical outcomes, proposals have been made for the addition of biologic factors and membranes, such as enamel matrix derivative, platelet-rich plasma, platelet-rich fibrin, and collagen membranes.<sup>8</sup>

A novel membrane that has been recently employed for guided tissue regeneration is the placental membrane. The placental allografts possess antibacterial and antimicrobial properties with immune privilege and are thus quite different from cadaveric allograft, xenograft, and alloplastic barrier membranes used in periodontal therapy.<sup>8</sup> Coronally Advanced Flap procedure (CAF) has been tried with varying degrees of success to cover the recession defects. Histologically, this technique leads to the reformation of junctional epithelium and the connective tissue attachment with the minimal bone repair but is not stable over a long period. Thus, there has been a desire to find a substitute for the autogenous donor tissue. Recently, newer xenogenic collagen matrices have been developed, which have resulted in significant improvement in the clinical parameters.

The final goal of root coverage procedures is the complete coverage of the recession with pleasant esthetic outcomes (Cairo et al. 2009). Since root coverage can be achieved with different approaches, the selection of the proper treatment approach requires a decision-making process that keeps account several aspects, like the morphology of the recession and the neighbouring periodontal tissues, the clinical efficacy of the surgical procedure, its morbidity, the skill ability required for its application and the cost-benefit ratio

### Strength and relevance of evidence:

The following 8 articles have been included in the systematic review, which has analysed the efficacy of Coronally Advanced Flap alone and Coronally Advanced Flap with various adjunctive to it for the treatment of Gingival Recession.

Cairo F et al.<sup>10</sup> conducted a Randomized Controlled Trial (Table no. 1-8) on A total of 29 patients with one recession were enrolled; 15 patients were randomly assigned to CAF + CTG while 14 to CAF alone where he concluded No difference was detected in term of RecRed. CAF +CTG was associated with longer surgical time, the higher number of

days with postoperative morbidity and the need for a greater number of analgesics than CAF alone. No difference for the final RES score was detected.

Kuis D et al.<sup>11</sup> conducted a study (Table no. 1-8) on Thirty-seven patients with 114 bilateral, single Miller Class I and II GR defects were treated with CAF on one side of the mouth and CAF+CTG on the other side where Both surgical procedures (CAF and CAF+CTG) are effective in the treatment of single Miller Class I and II GR defects since both resulted in the reduction of REC and increase of KT. CAF+CTG provided a better long term clinical outcome than CAF alone.

Cairo F et al.<sup>12</sup> conducted a study (Table no. 1-8) on 24 of the 29 patients from which 13 were treated with CAF + CTG and 11 with CAF with a follow up of 3-year follow-up. The blind and calibrated examiner measured the outcome that included complete root coverage (CRC), recession reduction (Rec-Red), Root coverage Esthetic Score (RES) and Keratinized Tissue (KT) Gain. Visual Analogue Scale (VAS) for evaluation of patients satisfaction. CAF + CTG resulted in better outcomes in terms of CRC than CAF alone 3 years later. In terms of RecRed, RES score and VAS values no difference was detected. Also, CAF + CTG was associated with higher KT gain than CAF.

Jepson K et al.<sup>2</sup> conducted a study (Table no. 1-8) where there was a high correlation between 6 months and 3 years RC outcomes for both CAF procedures. Mean RC following CAF + CMX amounted to 89.9% after 6 months and 91.7% after 3 years (Pearson's correlation: 0.91). The corresponding values for CAF were 83.7 % vs. 82.8 % (Pearson's correlation: 0.94). Likewise, CRC was stable with 61/61 % for CAF + CMX and 39/39% for CAF after 6 months/3 years, respectively.

Sangiorgio P et al.<sup>6</sup> conducted a study (Table no. 1-8) where obtained root coverage was 68.04 ± 24.11% for CAF; 87.20 ± 15.01% for CAF+CM; 88.77 ± 20.66% for CAF+EMD and 91.59 ± 11.08% for CAF+CM+EMD after 6 months, with the groups receiving biomaterials showing greater values. Complete root coverage for CAF+EMD was 70.59%, significantly superior to CAF alone (23.53%); CAF+CM (52.94%) and CAF+CM+EMD (51.47%). Keratinized tissue thickness gain was significant only in CM treated groups.

Santos R et al.<sup>13</sup> conducted a study (Table no. 1-8) The impact of oral health on quality of life after 6 months was significant for CAF + CM, CAF + EMD and CAF +CM + EMD (p <0.05). Total OHIP-14 score and psychological discomfort, psychological disability, social disability and handicap dimensions showed a negative correlation with esthetics. Rasperini G et al.<sup>15</sup> conducted a chance to gain and preserve CRC over time is equal to 70% in the CAF+CTG group Using the CTG, an increase of KT was recorded 9 years after the surgery (p=0.019). An OR of 0.12 (p=0.022) of not

achieving CRC was observed in cases with NCCL compared to cases without NCCL.

George S et al.<sup>14</sup>(Table no. 1-8) conducted a study on there was a statistically significant reduction in the HGR, gain in the CAL, and WKT in group II compared to group I.

## LIMITATIONS

The limitations of the study are:-

1. There are no histological evaluation and co-relation studies conducted to evaluate the healing outcomes.
2. A larger sample size with a longer follow-up period will be required to access the predictability of this technique.
3. The intervention is technique sensitive which may alter the outcomes

## CONCLUSION

For gingival augmentation, various procedures and biomaterials have been used to date. Coronally Advanced Flap Technique with the use of various augmentation is effective in the management of gingival recession. All the Techniques used were effective in the management of the anterior isolated gingival recession. CAF with various augmentation resulted in the superior esthetic outcome when compared to only CAF.

## LIMITATIONS AND FUTURE IMPLICATIONS

1. Studies evaluating the histologic aspects of healing will help in establishing the predictability of the technique.
2. A larger sample size with a longer duration of follow-ups will be required to ascertain the predictability of the technique.

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**Source of Funding:** NIL

**Contribution:**

Idea and execution of the study- Dr. Ambilwade Komal S. and Dr. Gopalakrishnan D.

Study Selection and Implication-Dr.Ambilwade Komal S., Dr. Gopalakrishnan D.,

Dr. Martande Santosh.

**Results and Analysis-** Dr. Ambilwade Komal S., Dr. Martande Santosh., Dr. Deodhar Amol G.

Manuscript, Drafting and Approval-Dr.Ambilwade Komal S., Dr. Gopalakrishnan D.,

Dr. Martande Santosh., Dr.Deodhar Amol G.

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**Table 1: Study Design**

Study ID	Authors, Year of Publication	Location, Setting	Study Design	Defect	Patient Description
1	Cairo F et al. 2012	Italy ,Institutue	A randomised controlled clinical trial	A total of 29 patients with one recession were enrolled.	
2	Kuis et al. 2012	Croatia, Institute	A long-term Randomised clinical trial	37 patients with 114 bilateral, single Miller Class I and II GR.	12 males , 25 females aged 20 to 52 years
3	Cairo et al. 2015	Italy, Institutue	A randomised controlled clinical trial	A total of 29 patients with one recession were enrolled.	14 males, 15 females aged 27 to 64 years
4	Jepsen K et al. 2017	Germany, Institut	A randomised controlled trial	18 patients with Millers Class I and II GR	Patients aged more than 18 years
5	Sangiorgio et al. JPM, 2017	Campinas, Institute	A randomised controlled trial	A total of 68 participants with single Miller class I and II GR.	42 females and 26 males Patients aged more than 18 years
6	Rocha Dos Santos M et al. 2017	Brazil, Institute	A randomised controlled trial	A total of 68 participants with single Miller class I and II GR.	42 females and 26 males Patients aged more than 18 years
7	George S et al. 2018	India, Institute	A randomised controlled trial	60 teeth with Miller's Class I and II GR	15 patients
8	Gasperini G et al. 2018	Italy, Institutue	A randomised controlled trial	25 class I and II GR	

**Table 2: Intervention of each study considered in the article.**

Study ID	Authors, Year of Publication	Intervention 1	Intervention 2	Intervention 3	Intervention 4	Intervention 5
1	Cairo F et al. 2012	CAF ALONE	CAF + CTG			
2	Kuis et al. 2012	CAF ALONE	CAF + CTG			
3	Cairo et al. 2015	CAF ALONE	CAF + CTG			
4	Jepsen K et al. 2017	CAF ALONE		CAF+XCM		
5	Sangiorgio et al. JPM, 2017	CAF ALONE		CAF+ XCM	CAF +EMD	
6	Rocha Dos Santos M et al. 2017	CAF ALONE		CAF+CM	CAF +EMD	
7	George S et al. 2018					CAF + Placental Membrane
8	Rasperini G et al. 2018	CAF ALONE	CAF + CTG			

**Table 3: Evaluation of Probing Depth in Control and Test group of each study.**

Study ID	Authors, Year of Publication	PROBING DEPTH									
		Baseline Evaluation	CONTROL				Baseline Evaluation	TEST			
			3 Months	6 months	1 year	3 years		3 Months	6 months	1 year	3 years
1	Cairo F et al. 2012	1.4 ± 0.6	1.4 ± 0.6	1.4 ± 0.5		1.4 ± 0.6	1.5 ± 0.5	1.4 ± 0.5			
2	Kuis et al. 2012										
3	Cairo et al. 2015				1.1 0.3	1.3 0.5				1.5 0.5	1.7 0.9
4	Jepsen K et al. 2017	1.50 (0.54)		1.19 (0.35)	1.11 (0.47)	1.36 (0.54)	1.39 (0.50)		1.17 (0.38)	1.14 (0.44)	1.14 (0.51)
5	Sangiorgio et al. JPM, 2017	1.50 ± 0.75	1.50 ± 0.56	1.47 ± 0.54			CAF+XCM 1.44 ± 0.56 CAF+ EMD 1.47 ± 0.48	CAF+XCM 1.44 ± 0.56 CAF+ EMD 1.47 ± 0.48	CAF+XCM 1.44 ± 0.56 CAF+ EMD 1.47 ± 0.48		
6	Rocha Dos Santos M et al. 2017										
7	George S et al. 2018	1.87 ± 1.042	1.47 ± 0.507	1.40 ± 0.498			1.90 ± 0.803	1.17 ± 0.379	1.20 ± 0.407		
8	Rasperini G et al. 2018	1.2±0.4		1.1±0.2	1.1±0.2		1.3±0.5		1.1±0.2	1.3±0.3	

**Table 4: Evaluation of Clinical Attachment Loss in Control and Test group of each study.**

Study ID	Authors, Year of Publication	CAL									
		Baseline Evaluation	CONTROL				Baseline Evaluation	TEST			
			3 Months	6 months	1 year	3 years		3 Months	6 months	1 year	3 years
1	Cairo F et al. 2012	4.0 ± 1.0	2.5 ± 0.9	2.5 ± 0.8			4.3 ± 1.1	1.9 ± 1.2	1.8 ± 1.0		
2	Kuis et al. 2012										
3	Cairo et al. 2015	2.9 0.9			2.5 0.8	2.8 1.0	2.8 1.3			2.8 1.0	3.2 1.1
4	Jepsen K et al. 2017	4.61 (0.87)		1.75 (0.73)	1.61 (0.78)	1.94 (0.80)	4.58 (0.97)		1.50 (0.71)	1.44 (0.62)	1.42 (0.60)
5	Sangiorgio et al. JPM, 2017	4.72 ± 0.86	2.40 ± 1.11	2.54 ± 1.21			CAF+XCM 4.56 ± 0.68 CAF+ EMD 4.51 ± 0.59	CAF + XCM 1.83 ± 0.79 CAF+ EMD 1.84 ± 0.86	CAF + XCM1.69 ± 0.47 CAF + EMD 1.81 ± 0.82		
6	Rocha Dos Santos M et al. 2017										
7	George S et al. 2018	4.50 ± 1.408	2.87 ± 0.776	2.83 ± 0.791							
8	Rasperini G et al. 2018	3.5±1.0		1.8±0.4	1.9±0.5		3.7±0.8		1.9±0.7	1.8±0.5	

**Table 5: Evaluation of Gingival Recession in Control and Test group of each study.**

Study ID	Authors, Year of Publication	GINGIVAL RECESSION CONTROL					TEST				
		Baseline Evaluation	3 Months	6 months	1 year	3 years	Baseline Evaluation	3 Months	6 months	1 year	3 years
1	Cairo F et al. 2012	2.6 ± 0.6	0.4 ± 0.6	0.8 ± 0.6			2.9 ± 0.7	0.5 ± 0.5	0.4 ± 0.5		
2	Kuis et al. 2012	2.63 ± 0.75		0.25 ± 0.51	0.28 ± 0.49		2.63 ± 0.72		0.09 ± 0.34	0.09 ± 0.34	
3	Cairo et al. 2015	2.6 ± 0.6			0.7 ± 0.6	0.9 ± 0.8	2.9 ± 0.7			0.3 ± 0.5	0.5 ± 0.8
4	Jepsen K et al. 2017	3.11 (0.78)		0.56 (0.57)	0.50 (0.57)	0.58 (0.60)	3.19 (0.71)		0.33 (0.49)	0.31 (0.49)	0.28 (0.39)
5	Sangiorgio et al. JPM, 2017			3.22 ± 0.45	0.88 ± 0.77	1.06 ± 0.86	CAF+ XCM 3.12 ± 0.40 CAF+EMD 3.04 ± 0.31	CAF+ XCM 0.38 ± 0.51 CAF+EMD 0.31 ± 0.57	CAF+ XCM 0.41 ± 0.49 CAF+EMD 0.37 ± 0.66		
6	Rocha Dos Santos M et al. 2017										
7	George S et al. 2018										
8	Rasperini G et al. 2018	2.4 ± 1.0		0.7 ± 0.4	0.9 ± 0.4		2.4 ± 0.8		0.8 ± 0.7	0.6 ± 0.5	

**Table 6: Evaluation of Keratinised Tissue in Control and Test group of each study.**

Study ID	Authors, Year of Publication	CONTROL					KT TEST				
		Baseline Evaluation	3 Months	6 months	1 year	3 years	Baseline Evaluation	3 Months	6 months	1 year	3 years
1	Cairo F et al. 2012	2.8 ± 0.8	2.9 ± 0.8	2.8 ± 0.8			2.6 ± 1.0	3.7 ± 0.9	3.9 ± 0.6		
2	Kuis et al. 2012	1.33 ± 1.19		2.09 ± 0.71	2.21 ± 0.75						
3	Cairo et al. 2015				2.8 ± 0.8	2.5 ± 1.3				4.0 ± 0.8	4.5 ± 1.3
4	Jepsen K et al. 2017	2.22 (1.39)		2.83 (0.94)	2.94 (0.89)	3.25 (0.81)	2.14 (1.21)		3.56 (1.46)	3.61 (1.47)	4.06 (1.55)
5	Sangiorgio JPM, 2017	2.86 ± 1.30	3.07 ± 1.25	3.16 ± 1.26			CAF+ XCM 2.86 ± 1.30 CAF+EMD 2.59 ± 1.43	CAF+ XCM 2.67 ± 1.20 CAF+EMD 2.93 ± 1.18	CAF+ XCM 2.59 ± 1.43 CAF+EMD 2.66 ± 0.98		
6	Rocha Dos Santos M et al. 2017										
7	George S et al. 2018	1.73 ± 0.785	2.50 ± 1.042	2.43 ± 0.971			1.50 ± 0.731	3.43 ± 0.728	3.80 ± 0.551		
8	Rasperini G et al. 2018	3.8 ± 1.5		3.1 ± 0.4	2.9 ± 0.5		3.2 ± 1.0		2.8 ± 0.5	3.8 ± 0.9	

**Table 7: Evaluation of Visual Analogue Score in Control and Test group of each study.**

Study ID	Authors, Year of Publication	Baseline Evaluation	VAS								
			CONTROL			TEST					
			3 Months	6 months	1 year	3 years	Baseline Evaluation	3 Months	6 months	1 year	3 years
1	Cairo F et al. 2012	12.1 ± 7.6					7.3 ± 14.4				
2	Kuis et al. 2012										
3	Cairo et al. 2015										
4	Jepsen K et al. 2017										
5	Sangiorgio JPM, 2017										
6	Rocha Dos Santos M et al. 2017						CAF+XCM 4.45 ± 2.09 CAF+EMD 3.62 ± 2.63	CAF+XCM 8.01 ± 1.63 CAF + EMD 6.89 ± 2.46			
7	George S et al. 2018	5.29 ± 2.95		8.21 ± 2.03							
8	Rasperini G et al. 2018										

**Table 8: Summarised Conclusion of each study.**

Study ID	Authors, Year of Publication	
1	Cairo F et al. 2012	The additional use of CTG resulted in significant greater number of sites with CRC in maxillary teeth than CAF alone.
2	Kuis et al. 2012	CAF+CTG provided a better long term clinical outcome than CAF alone; this is corroborated by all evaluated clinical parameters in all observed follow-up periods.
3	Cairo et al. 2015	After 3 years, CAF + CTG resulted in better outcomes in terms of CRC than CAF alone. No difference was detected in terms of RecRed, RES score. Furthermore, CAF + CTG was associated with higher KT gain than CAF at the last follow-up
4	Jepsen K et al. 2017	CAF + CMX showed improved root coverage compared to CAF alone. - CAF + CMX achieved more gain in gingival thickness and increase in keratinized tissue width than CAF alone. - Both CAF and CAF + CMX provided equally successful patient-reported outcomes
5	Sangiorgio JPM, 2017	The study concluded that the associations of CAF+CM, CAF+EMD resulted in superior clinical outcomes regarding root coverage in comparison to CAF alone. The use of CM is associated with a slight (but significant) increase in gingival thickness that was not observed for CAF+EMD or CAF alone.
6	Rocha Dos Santos M et al. 2017	The study concluded that root coverage procedures may improve patient quality of life by impacting on a wide range of dimensions, perceived esthetics dissatisfaction of patients with GR
7	George S et al. 2018	Coronally-advanced flap with placental allograft provides a reliable technique for root coverage when compared to coronally-advanced flap alone.
8	Rasperini G et al. 2018	The additional use of CTG results in a significantly greater KT gain than CAF alone. The presence of NCCLs negatively affect the reduction of gingival recession and the complete root coverage in the long-term perspective