

Connective Tissue Graft with Coronally Advanced Flap Versus Concentrated Growth Factors Membrane in Treatment of Localized Periodontal recession. Split Mouth Comparative Clinical

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Keywords:

Periodontal recession, Sub-epithelial connective tissue, graft, concentrated growth factors.

ABSTRACT

This randomized split-mouth clinical experiment was conducted to evaluate the effect of concentrated growth factors membrane (CGF) versus sub-epithelial connective tissue graft (SCTG) for improving root coverage of localized periodontal recession. A total of twenty sites of a localized bilateral labial periodontal recession that limited to maxillary and mandibular incisors, canine, and premolars areas selected from 10 systemically healthy patients of both sexes, their ages ranged from 20-45 years old were enrolled in the study after fulfilling the inclusion criteria. The patients were randomly divided into two groups. Group I: 10 sites were treated with SCTG. Group II: 10 sites were treated with CGF membrane. Plaque index (PI), gingival index (GI), clinical attachment level (CAL), recession height (RH), recession width (RW), digital measurements of the area of recession (RA), and height of the keratinized tissue (HKT) were recorded at baseline and 1, 3, 6 and 12 months, except for PPD & CAL which were assessed at 6 and 12 months post-surgically. Gingival thickness (GT) was recorded at baseline and after 12 months post-surgically. Percentage of root coverage (RC) was recorded at 1, 3, 6, 12 months. Both groups resulted in significant improvement in all studied parameters at all the study evaluation periods as compared to their baseline value $p < 0.001$. There were no statistically significant differences between the two studied groups for all the studied parameters ($p < 0.05$) except for PI at 1 month in favor of group I, RA at 6 months in favor of group II, and root coverage at 1 month in favor to group II $p < 0.05$. There were non-significant differences between the two groups in terms of pain during surgery, improvement of root sensitivity, and the satisfaction after surgery $p > 0.05$ with a significant difference in terms of pain scores in favor of group II where group II complained the least pain $p < 0.05$. Within the limitation of this study, CGF membrane is comparable to SCTG in management of Miller's class II periodontal recessions with no discomfort and pain as in SCTG that shows potential clinical difficulties associated with the donor site surgery.



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1. INTRODUCTION

Gingival recession is one of the focal aesthetic complaints among participants. It is caused by a numerous of stimulating and precipitating aspects, including traumatic tooth brushing, tooth misalignment, periodontal disorder, excessive frenal attachment, traumatic blockage, and orthodontic treatment, as well as iatrogenic factors associated with restorative and periodontal treatment techniques. It may be localized or widespread and may occur on the tooth surfaces on the labial, lingual, or interproximal teeth surfaces [2]. It is commonly linked with dentine hypersensitivity, root caries, non-cariou cervical lesions, a lack of plaque control, and an unaesthetic view [3]. Over the years, periodontal plastic surgery aims to restore the periodontium to a functional, cosmetic, and healthy state. There are numerous mucogingival grafting techniques. The majority of these are useful in achieving reliable outcomes in specific types of localized recessions [4]. Systematic evaluations demonstrated that patients with gingival recession type I (RT I) (formerly designated as Miller classes I and II) can be effectively improved with CAF lonely or combined with soft tissue grafts and/or organic agents [5], [6].

Because of its considerable effectiveness in root coverage, adhesion and keratinized tissue gains, and general long-period stability, sub-epithelial connective tissue graft has been considered the gold standard for the treatment. The disadvantage of the SCTG procedure include the requirement for a second surgical site, an extended surgical time, and a risk of postoperative complications such as haemorrhage, recession, and bone loss at the donor site [7].

To resolve these limitations, studies have concentrated on the use of commercially available grafts such as amniotic membrane and collagen membrane., and an acellular dermal matrix (ADM) allograft which could be alternatives for harvesting SCTG [8], [9].

Recently concentrated growth factors (CGFs) were discovered initially by Sacco in 2006 [10]. CGF is an organic matrix composed of fibrin that involves growth factors, platelets, leukocytes, and CD34+ stem cells that help in the regeneration procedures. Additionally, it contains immune cells that help in the control of irritation and the prevention of infection [11]. Thus, (CGFs) can promote bone formation, increase the quality of newly created bone, and speed tissue healing.

CGFs are the third generation of platelet concentrate generated by blood samples centrifugation at alternate and regulated speeds with a specialized centrifuge that isolates a considerably fibrin matrix that is bigger and denser rich in growth factors than PRP or PRF [12]. CGF has a greater adhesive and tensile strength, as well as a greater viscosity, than other platelet formation [11].

Therefore, the recent research was established as a randomized split-mouth clinical trial to assess whether CGFs membrane and SCTG combined with coronally positioned flap can improve gingival phenotype and root coverage of localized periodontal recession defects.

2. Materials and Methods

This a split-mouth randomized clinical experiment was carried out in the period from August 2020 to September 2021. The patients participating in this study were chosen from the clinic's outpatient of the Periodontology Department, Faculty of Dentistry, Tanta University. The aim of the resent research was explained to the participants and informed consents were obtained according to the guidelines on human

research taken up by the Research Ethics Committee, Faculty of Dentistry, Tanta University. A total of twenty sites of a localized bilateral labial periodontal recession that limited to maxillary and mandibular incisors, canine, and premolars areas were selected from 10 systemically healthy patients of both sexes (7 females and 3 males), their ages ranged from 20-45 years old were eligible to participate in the research if they matched the inclusion criteria.

2.1 Inclusion Criteria

1. Appearance of bilateral localized teeth with periodontal recession type 1 (RT1) Cairo classification: (GR with no interdental attachment loss) in anterior teeth, [5] (miller class II gingival recession old classification). The interdental CEJ is not detectable clinically on the buccal/labial surfaces of the teeth.
2. Gingival recession depth (GRD) ≥ 2 mm.
3. Probing depth (PD) < 3 mm.
4. Adequate width of the keratinized gingiva (WKG) presents recession's apex.
5. Optimal compliance as confirmed by no missed treatment visits and a positive approach toward oral hygiene.

2.2 Exclusion Criteria

1. Appearance of any systemic disease that may affect therapy's outcome.
2. Presence of any risk factor e.g., smoker, Pregnant and lactating patients.
3. Previous periodontal surgical history treatment in quadrant selected for the trial.
4. Thin gingival phenotype.

2.3 Patient Grouping

20 selected sites in 10 patients were randomly divided using a computer random allocation program (Random Allocation Software Version 1.0) into equally groups as follows:

- Group I (control group): 10 patients have been administered SCTG + coronally advanced flap.
- Group II (study group I): 10 patients have been administered with CGF membrane + coronally advanced flap.

2.4 Methods

2.4.1 Initial Therapy

Each patient had initial therapy that included instructions on proper dental hygiene, scaling and root planing, Polishing professionally with a rubber cup and a non-abrasive polishing paste. Coronoplasty and sulcus deepening operations were performed if needed fig (1). To minimize brushing trauma on teeth with recession-type abnormalities, a modified Stillman's brushing technique was advised. Instructions of plaque control were repeated until participants recorded a plaque score of ≤ 1 . The participant's plaque control and tissue reaction were re-assessed 4 weeks later.

2.5 Surgical Procedures

Mepivacaine was used to anaesthetize the operative areas (1:100,000 adrenaline). The flap design started with a sulcular incision which was done at the facial element of the included teeth. At the CEJ level horizontal incisions were then performed at right angles to the neighboring interdental papillae. Two oblique incisions were performed at the mesial and distal line angles of the tooth extending beyond the MGJ. De-epithelialization of the interdental papillae mesial and distal to the recession defect created connective tissue beds for the surgical papillae. Following penetration of the periosteum, a full-thickness trapezoidal flap was lifted to the mucogingival junction (MGJ), and a partial-thickness flap was dissected farther at apex. fig (2). Root planing was employed to polish and harden the exposed root surfaces. After conditioning the root for

two minutes with a saturated tetracycline solution (10mg/ml), it was rinsed for one minute. fig (2)

The size and dimension of the SCTG were determined using a sterile aluminum foil template. The gauze was placed on the recipient site till harvesting the SCTG from the place of the donation.

2.5.1 SCTG Harvesting (Study Group 1)

SCTG was harvested using a single incision technique with a scalpel (blade 15c). To remove dead space and control bleeding, the palatal flap was adjusted, and the donation site was squeezed with wet gauze. Following that, sutures were used to close the palate flap [3].

CTG placement: the graft was adequately placed to meet the recipient sites and sutured to the papillae by 5-0 biodegradable suture. The flap was subsequently advanced coronally to entirely layout the CTG using simple interrupted and sling sutures fig (2).

Group II (CGF) membrane:

Preparation of the membrane

10 ml of venous blood from the participants was obtained via venipuncture of the antecubital vein into a glass that has been sterilized test tube (vacutainer) without anticoagulant. It centrifuged instantly (Medifuge, Silfradentsrl, Sofia, Italy) for 30 s speed, 2 min at 2700 rpm, for 4 min at 2400 rpm, for 4 min at 2700 rpm, then for 3 min at 3000 rpm, and 36 s deceleration till the end.

At the conclusion of the procedure, three blood phases were formed: a serum (blood plasma devoid of fibrinogen and coagulation factors, platelet-poor plasma, PPP); an interim phase consisting of a very large and dense polymerized fibrin block containing CGFs, stem cells, and white blood cells; and the lower RBC layer. Using two sterile glass slides, separate the blockage of fibrin from the red phase and push it to a membrane. fig (3).

CGFs membrane was trimmed and amended over the entire defect to cover the root surface. Then the flap was coronally developed to totally layout the membrane using simple interrupted and sling sutures fig (3).

Post-Operative Care:

- Non-steroidal anti-inflammatory tablet every 8 hours (Ibuprofen 600 mg), was taken according to individual needs.
- An antibiotic capsules every 8 hours (Amoxicillin, 500 mg) was prescribed for 7 days after the duration of surgery.
- Participants were guided to prevent brushing over the treated side and wash with 0.2% chlorhexidine mouth wash for 2 weeks.
- They were advised not to interrupt the pack and prevent unnecessary injury to the surgical site.
- The periodontal pack was removed one week after surgery. Healing has been observed, and if necessary, a second pack has been applied.
- Sutures were removed three weeks later.
- Participants were directed to use a cotton ball soaked with 0.2% chlorhexidine mouth wash to cleanse surgical area for a week in an apico-coronal course and brush with a soft toothbrush.
- Subjects were recalled 3, 6, and 9 months following surgery for clinical measurements.

Clinical Measurements:

The presented clinical variables were evaluated and documented at baseline, 3, 6, and 12 months after surgery.

1. Plaque index (PI) [13].
2. gingival index [14]
3. (GRD) was determined from the (CEJ) to the most apical point of the gingival edge on the mid-buccal face of the tooth (GM).
4. At the level of the CEJ gingival recession width (GRW) was evaluated in the mesiodistal direction of the GM.
5. Height of keratinized tissue (HKT) was measured as the distance between the GM and the MGJ.
6. Clinical attachment loss (CAL) was determined from the CEJ to the down of the sulcus on the mid-buccal face of the teeth [15].
7. Gingival thickness (Gingival biotype GT) was determined at the mid-buccal aspect of a treated tooth on the long axis, 3 mm apically from the GM based on the transparency of the gingiva {i.e., how easily the periodontal probe could be seen through the gingival margin while probing the buccal sulcus ((at baseline and after 12 months' post-surgery) [16]
8. Percentage of root coverage was calculated by the following formula: $(GRD \text{ baseline} - GRD \text{ 3,6, and 12 months}) / GRD \text{ baseline} \times 100\%$.
9. Digital measurements: all recession areas were photographed before surgery (baseline), 3,6,12 months postoperatively. The photos were taken by a digital camera at a fixed resolution (mega pixel). The recession areas were examined and determined by a special graphic computer software program (AutoCAD, Autodesk, Inc., San Rafael, CA, USA.)
10. At the 12-month follow-up assessment, questionnaires were issued to the participants for subjective assessment of esthetics and overall satisfaction (degree of clinical significance) which involved:
 - a) Pain presented by the participant in surgery by visual analog scale (VAS) score
 - b) Pain presented by the participants after surgery by (VAS) score
 - c) Satisfaction after surgery
 - d) Improvement in root sensitivity

2.6 Statistical analysis

The Statistical Program for Social Sciences SPSS version 22 was used to examine the data (IBM, Armonk, NY, United States of America).

The mean and standard deviation of quantitative data were determined (SD). Frequency and percentages were used to represent qualitative data.

For comparison two means, the independent-samples t-test of significance was performed.

For comparison more than two means, a one-way analysis of variance (ANOVA) is used.

For comparison proportions between two qualitative factors, the Chi-square (X²) test of significance was performed (gingival thickness, and the level of significance).

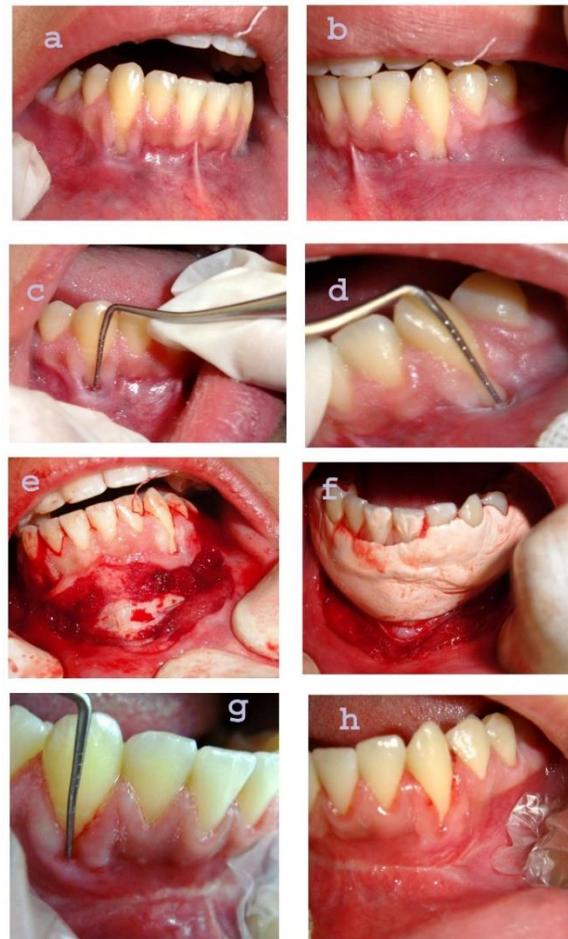


Fig (1) a,b,c,&d bilateral gingival recession at the facial gingival of the canine with high frenum attachment and shallow vestibule e. Vestibular deepening operation is done from canine to canine f. Periodontal pack in place to prevent recurrence of attachment of the frenum g & h Post-operative reduction of the amount of recession

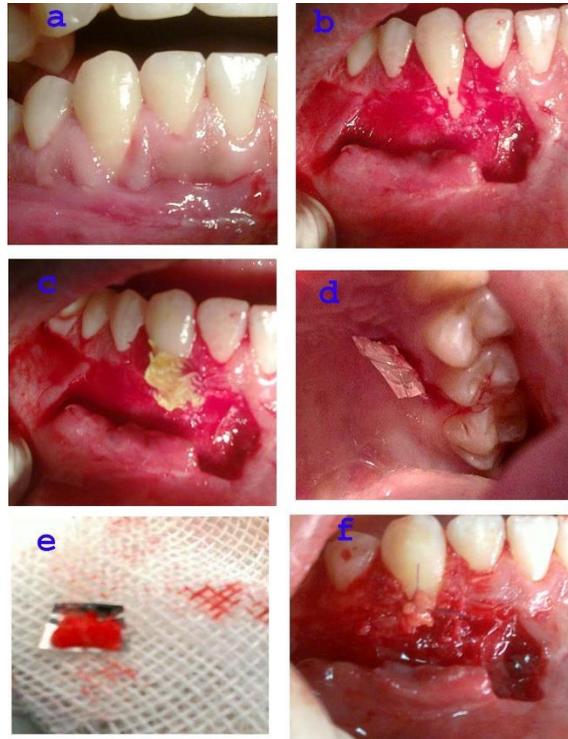


Fig (2): a. Lower right canine with Millar class II gingival recession b. Flap design for the recipient sites. c. root surface was planed and conditioned with a saturated tetracycline hydrochloride solution (10 mg/ml) for 2 minutes d. Harvesting the SCTG e. The harvested SCTG f. SCTG was adapted and sutured at the recipient site (group I)



FIG (3): a&b Preparation of concentrated growth factor membrane for group II c. CGF Membrane was placed and adapted on the recipient site without sutures d. The flap was coronally advanced and sutured

3. Results

A total of 20 class II Miller periodontal recession areas in 10 patients (7 females and 3 males) their ages

ranged from 20-45 were completed the study without dropout. No undesirable reactions such as inflammatory reactions or wound healing complications were observed during the study period.

Baseline data showed insignificantly different between the two groups regarding all the tested parameters $p > 0.05$. The outcomes of the recent research revealed that both therapy modules lead to a significant decrease of PI, GI, CAL, RD, RW, RA, and significant increase HKT, RC, and GT at all the study evaluation periods than their baseline value $p < 0.001$ table (1,2&3), fig (4 &5)

Intergroup comparison showed that there were insignificant different between the two studied groups for all the studied variables ($p < 0.05$) except for PI at 1 month a significant different was found between them in favor of group II, $p < 0.05$, and for RA where there was a significant difference at 6 months in favor to the group I, ($p < 0.05$) and for root coverage at one month was significantly different in favor to group II, $p < 0.05$, as presented in table (1,2&3)

Table (1): Mean values of plaque index (PI), gingival index (GI), clinical attachment level (CAL in mm), recession depth (RD in mm) among the study groups at evaluation periods.

Variables	Time groups	Group I (SCTG) (n=10) Mean± SD		Group II (CGF membrane) (n=10) Mean± SD		t. test	P. value
PI	Baseline	2.00 ± 0.67	P1	2.00 ± 0.67	P2	0.000	1.000
	1 month	1.00 ± 0.00	0.001*	0.30 ± 0.48	0.001	4.583	0.001*
		0.40 ± 0.52	0.001*	0.30 ± 0.48	0.001	0.447	0.660
	3 months	0.60 ± 0.52	0.001*	0.30 ± 0.48	0.001	1.342	0.196
	6 months	0.60 ± 0.52	0.001*	0.40 ± 0.52	0.001	0.866	0.398
12 months							
GI	Baseline	2.20 ± 0.42	P1	2.20 ± 0.42	P2	0.000	1.000
	1 month	0.60 ± 0.84	0.001*	0.80 ± 0.63	0.001	0.600	0.556
		0.40 ± 0.52	0.001*	0.50 ± 0.53	0.001	0.429	0.673
	3 months	0.30 ± 0.48	0.001*	0.20 ± 0.42	0.001	0.493	0.628
	6 months	0.40 ± 0.52	0.001*	0.40 ± 0.52	0.001	0.000	1.000
12 months							
CAL	Baseline	4.00 ± 0.67	P1	3.90 ± 0.57	P2	0.361	0.722
	3 months	2.20 ± 0.42	0.001*	1.90 ± 0.32	0.001	1.800	0.089
	6 months	1.60 ± 0.52	0.001*	1.60 ± 0.52	0.001	0.000	1.000
	12 months	1.60 ± 0.52	0.001*	1.80 ± 0.42	0.001	0.949	0.355
RD	Baseline	3.20 ± 0.63	P1	3.20 ± 0.63	P2	0.000	1.000
	1 month	2.30 ± 0.45	0.001*	2.20 ± 0.40	0.001	1.790	0.095
		2.00 ± 0.47	0.001*	1.90 ± 0.32	0.001	0.557	0.584
	3 months	1.60 ± 0.52	0.001*	1.50 ± 0.53	0.001	0.429	0.673
	6 months	1.80 ± 0.42	0.001*	1.80 ± 0.42	0.001	0.000	1.000
12 months							

Table (2): Mean values of recession width (RW in mm), %root coverage (RC), keratinized height thickness (KHT in mm), recession area (RA in mm²) among the study groups at evaluation periods.

Variable s	Time groups	Group I (SCTG) (n=10) Mean± SD		Group II (CGF membrane) (n=10) Mean± SD		t. test	P. value

RW	Baseline	3.35 ± 0.58	P1	3.35 ± 0.53	P2	0.000	1.000
	1 month	1.70 ± 0.48	0.001*	1.70 ± 0.48	0.001	0.000	1.000
	3 months	1.50 ± 0.53	0.001*	1.50 ± 0.53	0.001	0.000	1.000
	6 months	1.40 ± 0.52	0.001*	1.50 ± 0.53	0.001	0.429	0.673
	12 months	1.60 ± 0.52	0.001*	1.90 ± 0.32	0.001	1.567	0.135
Root coverage RC	1 month	72.10 ± 4.09	P1	76.00 ± 2.91	P2	2.456	0.024*
	3 months	79.70 ± 2.95		80.40 ± 4.79	0.12	0.394	0.698
	6 months	81.60 ± 2.46	0.001*	80.00 ± 4.83	0.18	0.933	0.363
	12 months	80.50 ± 3.69	0.001*	79.20 ± 4.54	0.36	0.703	0.491
KHT	Baseline	0.58 ± 0.23	P1	0.65 ± 0.24	P2	0.670	0.511
	1 month	1.90 ± 0.21	0.001*	1.90 ± 0.32	0.001	0.000	1.000
	3 months	2.40 ± 0.46	0.001*	2.50 ± 0.53	0.001	0.452	0.656
	6 months	2.45 ± 0.50	0.001*	2.85 ± 0.34	0.001	2.105	0.051
	12 months	2.50 ± 0.53	0.001*	2.30 ± 0.48	0.001*	0.885	0.388
Recession area (RA)	Baseline	28.03 ± 1.67	P1	27.98 ± 1.33	P2	0.083	0.935
	3 months	21.08 ± 1.33	0.001*	20.53 ± 1.10	0.001	1.004	0.329
	6 months	2.12 ± 0.44	0.001*	3.75 ± 0.31	0.001	9.632	0.001*
	12 months	8.52 ± 1.63	0.001*	8.74 ± 3.22	0.001	0.192	0.850

Table (3): Table 3: the effect of the two different treatment modalities on gingival thickness during the different study intervals

Gingival thickness		G I (N=10)		G II (N=10)		X ²	P-value
		N	%	N	%		
Baseline	Thin	9	90	8	80	0.387	0.531
	Thick	1	10	2	20		
12 m.	Thin	0	0	3	30	3.528	0.060
	Thick	10	100	7	70		
X ²		16.362		5.048			
P-value		0.001*		0.025*			

3.1 Level of significance results

Results showed an insignificance difference between the two groups in terms of pain during surgery, enhancement of root sensitivity, and satisfaction after surgery $p > 0.05$. However, in terms of post-operative aching, a significant difference presented between the two groups in favor of group II where group II complained the least pain $p < 0.05$, as presented in table (4)

Table 4: Comparison of patient's satisfaction questioner in the two treatment groups

	G I (N=10)	G II (N=10)	X ²	P-value

		N	%	N	%		
Pain during surgery	Yes	0	0	0	0	0.0	1.0
	No	10	100	10	100		
	Somewhat	0	0	0	0		
Pain after surgery	Yes	6	60	1	10	7.502	0.023*
	No	2	20	8	80		
	Somewhat	2	20	1	10		
Satisfaction	Yes	8	80	5	50	2.892	0.235
	No	0	0	2	20		
	Somewhat	2	20	3	30		
Improvement	Yes	8	80	7	70	0.403	0.819
	No	1	10	2	20		
	Somewhat	1	10	1	10		

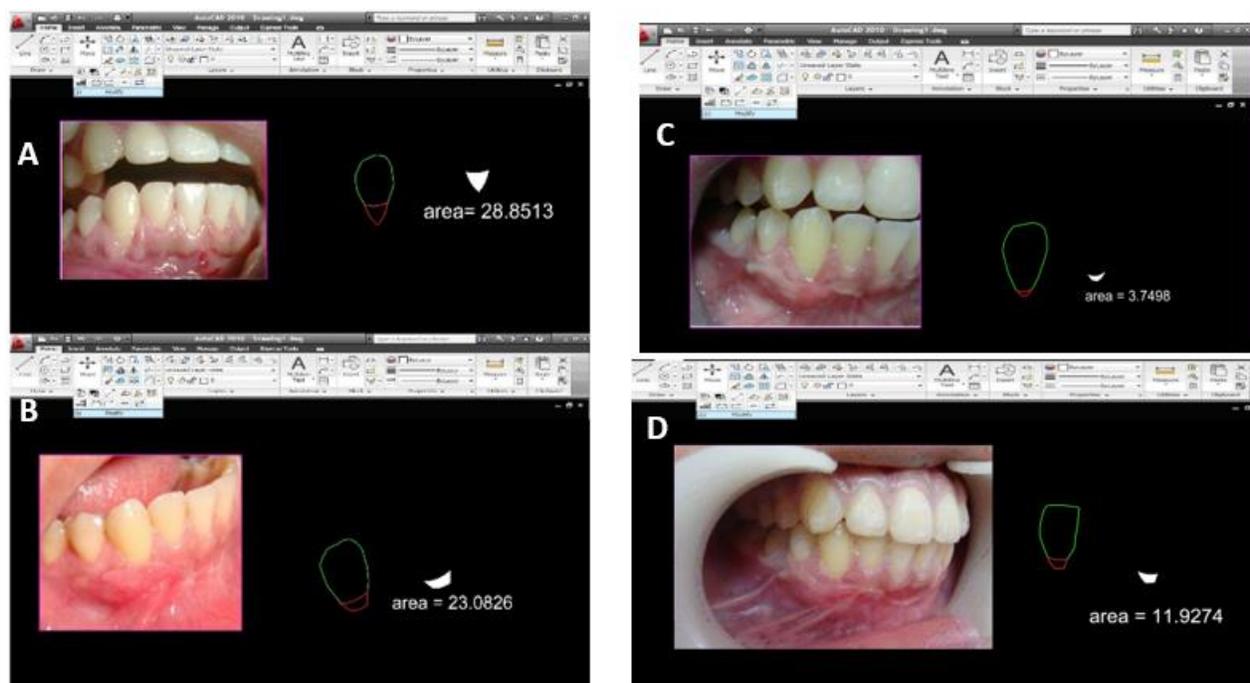


Fig (4) Miller class II buccal gingival recession treated with CTG (group I); A) digital measurement of recession area at baseline; B) digital measurement of recession area at 3 months post-surgically; C) digital measurement of recession area at 6 months; D) digital measurement of recession area at 12 months post-surgically

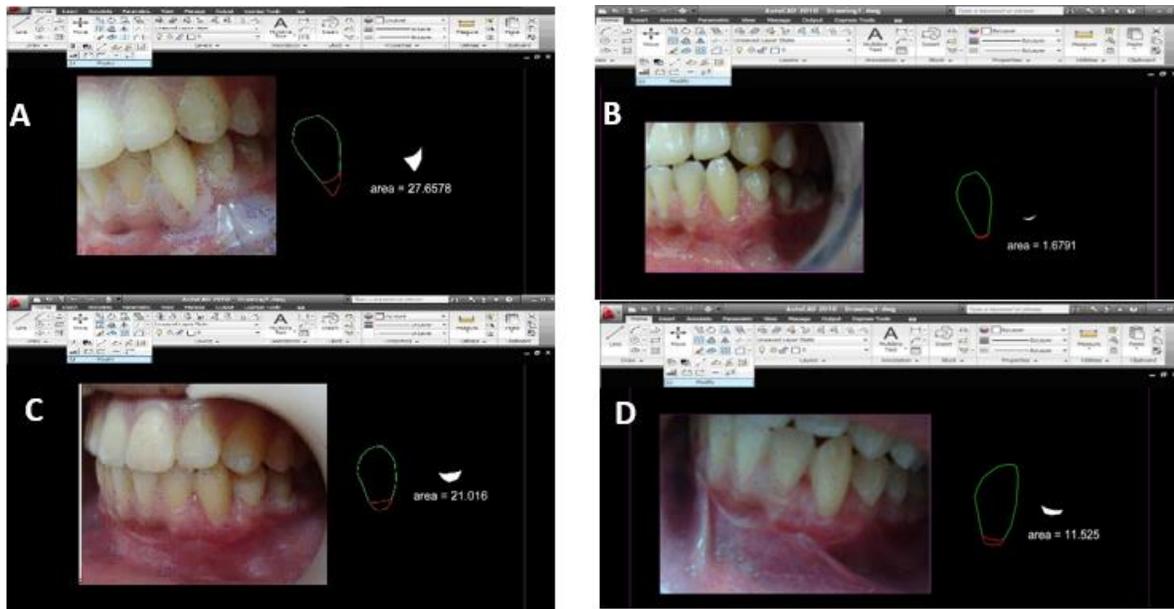


Fig (5) Miller class II buccal gingival recession treated with CGF membrane (group II); A) digital measurement of recession area at baseline; B) digital measurement of recession area at 3 months post-surgically; C) digital measurement of recession area at 6 months; D) digital measurement of recession area at 12 months post- surgically

4. Discussion

The goal of treatment of periodontal recession is the Complete covering of recession defects with new reattachment, an attractive colour and tissue integration between the treated area and neighboring tissues, resulting in biologic and aesthetic success. Thus, it is necessary to determine the most predictable and easily performed surgical procedures [17]. The recent trial was aimed to assess the clinical benefits of using CGF membrane than SCTG in the treatment of Miller class II gingival recession disorders. The recent study concluded in significant enhancement in all clinical variables in SCTG than their baseline values along the different study periods. This improvement may be attributed to the flap design (coronally advanced) that resulted in good root coverage. These outcomes for root coverage were linked with a clinically and statistically significant increase in clinical attachment [18].

These findings are in consistent with [19], [20], who demonstrated that treatment of gingival recession with SCTG+CAF resulted in improvement of all tested parameters at all the study periods.

Similarly, CGF membrane showed considerable enhancement in all clinical variables comparable to SCTG at all the study intervals this may be explained by that CGF has increased tensile strength, more growth factors, increased viscosity, and higher adhesive strength than PRF so it promotes the healing process of tissue enhances osteogenesis and reduces tissue loss in healing period [21], [22].

Additionally, As demonstrated in the study done by [23] CGF acts as a membrane support in recession coverage by continuously releasing growth factors to promote tissue regeneration [23]

The rise in KHT and GT in the group II may be explained by biology of CGF, which includes much larger, denser, and richer in GFs fibrin matrix this agrees with [21], [24]. Our results were copied with [25] who demonstrated that The CGF barrier membrane has the ability to speed soft tissue healing, which when paired with root covering techniques such as the sliding flap method resulted in the predicted increase in the width

of the connected gingival in class II gingival recession impairments.

This results are also consistent with [26] who investigated the effects of CGF on gingival emphysema. The effects of CGF on gingival mesenchymal stem cells (GMSCs) proliferation and migration; collagen-1 (Col-1), fibronectin (FN), vascular endothelial growth factor (VEGF), and angiopoietin-1 (Ang-1); and the AKT, Wnt/-catenin, and Yes-associated protein (YAP) signaling ways were investigated. They discovered that CGF can enhance gingival regeneration and that YAP trafficking into the nucleus may play a critical role in this action.

Our results disagree with [27], who reported that CGF could not aid as a direct biomaterial substitute for the gold standard CTG. Additionally, inconsistent with [20] concluded that CGF did not improve clinical results, particularly primary-outcome RC and SCTG is higher to CGF with CAF. However, CGF may be preferred since it results in less postoperative discomfort.

Less post-operative pain may be related to the action of CGF since it acts by Degranulation of alpha granules in platelet, which carry growth factors that are critical for early wound healing and have an anti-angiogenic effect on chronic non-healing wounds. Our outcomes were in line with [28], [29] who reported that CGF is effective in relieving pain and expedite wound healing than traditional therapy.

It was observed that there were an insignificance differences between the two groups at all evaluation periods except for PI at one month in favor to group II this can be explained by the patients after SCTG could not effectively perform plaque control because of pain from the donor sites while patient after CGF membrane can perform plaque control easily.

Additionally, CGF membrane resulted in good early root coverage than SCTG at one month and this can be explained by that the early graft retraction, resulting in partial root exposure [29].

Owing to the findings of the current study, within the limit of this study it can be claimed that CGF membrane provides comparable clinical outcomes in addition to greater patient benefits makes it a reliable and safe alternative to SCTG in the management of localized Miller Class II gingival recession.

Data Availability Our study's data may be shared with interested parties upon request.

Conflicts of Interest The authors report no conflicts of interest related to this study.

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