COMPARATIVE EVALUATION OF CORONALLY ADVANCED FLAP WITH ORTHODONTIC BUTTON APPLICATION WITH AND WITHOUT PLATELET RICH FIBRIN MEMBRANE IN TREATMENT OF MULTIPLE GINGIVAL RECESSION DEFECTS: A CLINICORADIOGRAPHIC STUDY

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LIST OF ABBREVIATIONS

Sr. No.	Short Form	Full Form
1	ADM	Acellular dermal matrix
2	CAL	Clinical attachment level
3	CAF	Coronally advanced flap
4	CAF+B	Coronally advanced flap with orthodontic button application
5	CEJ	Cementoenamel junction
6	CRC	Complete root coverage
7	CBCT	Cone-beam computed tomography
8	CPF	Coronally positioned flap
9	CT	Computed tomography
10	CTG	Connective tissue graft
11	EMD	Enamel matrix derivative
12	FGG	Free gingival graft
13	GC	Gingival color
14	GI	Gingival index
15	GM	Gingival margin
16	GMB	Distance of facial alveolar bone crest to gingival margin
17	GRD	Gingival recession depth
18	GT	Gingival thickness
19	PD	Probing depth
20	PI	Plaque index
21	PPD	Probing Pocket Depth
22	PPP	Platelet poor plasma
23	PRP	Platelet rich plasma
24	PRF	Platelet rich fibrin
25	%RC	Percentage root coverage
26	KTW	Keratinized tissue width
27	MARTD	Multiple adjacent recession type defects
28	MCAF	Modified coronally advanced flap
29	MGJ	Mucogingival junction
30	MRC	Mean root coverage
31	MTC	Marginal tissue contour
32	RCT	Randomized control trial
33	RD	Recession depth
34	RES	Root coverage aesthetic score system
35	RW	Recession width
36	SCTG	Subepithelial connective tissue graft
37	STT	Soft tissue texture
38	UNC	University of North Carolina
39	VAS	Visual analog scale
40	VAS-P	Visual analog scale for aesthetic
41	VAS-P	Visual analog scale for pain

INTRODUCTION

In modern medicine, marginal gingival tissue recession is becoming a common concern of the patient often requiring treatment for aesthetic reasons. Deep recessions often affecting the anterior teeth in young age group is significantly associated with patient request for treatment.

The displacement of the soft tissue margin apical to the cement enamel junction (CEJ) not only exposes the root surface but also impairs the aesthetics. Marginal gingival tissue recession is associated with several factors with complex etiology. Traumatic tooth brushing is considered as one of the main causative factor

for the development of recessions commonly creating a wedge shaped defect at cervical area. A five year study showed that with the level of oral hygiene education, probability of gingival recession also increases.[1]

However, the exact mechanism of gingival recession is not well understood. Risk factors considered to be associated with gingival recession include tooth malposition, path of eruption, tooth shape, profile and position in the arch, alveolar bone dehiscence, muscle attachment and frenal pull, periodontal disease and treatment, iatrogenic restorative or operative treatment, improper oral hygiene methods (e.g. tooth brushing, floss, interproximal brush) and other self-inflicted injuries (e.g. oral piercing) while the most important factor increasing the risk of gingival recession may be a thin gingival biotype where a delicate marginal tissue is covering a non-vascularized root surface.[2]

PREVALENCE/ FREQUENCY

Gingival recession of 1 mm or more at one or more sites is one of the common finding seen in more than 50% of the population. It is prevalent in patients with good as well as poor oral hygiene. Buccal surfaces are often involved in patients with good oral hygiene,[3,4] whereas all tooth surfaces get affected in patients suffering from periodontal disease or after periodontal treatment. [5]

Gingival recession has also been linked to ethnicity. It has been seen that Mexican Americans and non-Hispanic whites exhibited lesser prevalence and extent of gingival recession compared to non-Hispanic blacks.[6] Refuting this observation no difference in terms of prevalence of gingival recession was found between whites and non-whites in an epidemiological study.[7]

The extent and prevalence of gingival recession increases with age. As compared to females, males have shown to exhibit greater levels of recession.[7] The association of tobacco smoking in the etiology and prevalence of recession as discussed by several authors is controversial. However, more extensive recessions were seen in smokers than non-smokers in some studies.[7]

CLASSIFICATION

A clinical classification of gingival recession proposed by **Miller (1985)**[8] in four categories according to the relationship with the mucogingival line and interproximal bone is widely accepted and a predictive value for root coverage in each class has been proposed. This classification is as follows -

Class I : Marginal tissue recession not extending to the mucoginvival junction (MGJ) with no interdental bone loss

Class II : Marginal tissue recession extending to or beyond the MGJ with no interdental bone loss

Class III : Marginal tissue recession extending to or beyond the MGJ with bone or soft tissue loss in the interdental area or malpositioning of the teeth

Class IV : Marginal tissue recession extending to or beyond the MGJ and bone or soft tissue loss in the interdental area and/or severe malpositioning of teeth

Although in this classification some important factors such as biotype, root prominency and supporting bone were not considered, it is used in most studies considering its use in communication and simplicity.

Treatment of Gingival Recession

Formerly occasional attempts were made to cover the denuded root surfaces solely for the cosmetic purpose and to decrease the root sensitivity. One of the main concern in not attempting these cosmetic surgeries was the poor predictability of the treatment outcome. Hence the treatment of gingival recession was mainly focused on halting the progression of gingival recession, preserving a band of keratinized tissue thus enhancing plaque control, decreasing frenum pull and preventing post-orthodontic and post-prosthetic marginal tissue recession. With the coming years focus was shifted and objectives were modified for the benefit of patient. Regeneration of lost tissue along with arresting the progression of disease became the aim of gingival recession treatment. Considering the higher aesthetic concern the goal of root coverage procedure now is not only to obtain full root coverage of a denuded root but also to blend the mucosa and or keratinized gingiva around the recession defect in most aesthetic way and reduced root sensitivity without any residual periodontal pocket.

The use of predictable periodontal surgical procedure determines the outcome of treatment. The term predictable periodontal surgery was first proposed by Miller in 1988 comprising different surgical techniques intended to correct and prevent anatomical, developmental, traumatic or plaque disease-induced defects of the gingiva, alveolar mucosa or bone.

Since the beginning of the 20th century, various surgical procedures have been proposed for achieving root coverage. Use of pedicle or free soft tissue grafts to cover denuded root surfaces was first described by Younger in 1902, Harlan in 1906 and

Rosenthal et al. in 1911.[9] These techniques were abandoned for a long time up to the end of the 1950s. From these decades laterally repositioned flaps, free gingival grafts (FGG), subepithelial connective tissue grafts (SCTG) and CAFs have been used to improve various clinical parameters such as recession depth (RD), clinical attachment level (CAL) and keratinized tissue width (KTW).

Plastic periodontal procedures used for root coverage are usually classified as pedicle soft tissue graft (lateral sliding flap and its modifications) and free soft tissue grafts. Coronally positioned or coronally advanced flap (CAF) procedure is based on the coronal shift of soft tissue present apically to the denuded root surface which can be used as an alternative to lateral sliding flap.[10,11] Applicability of this procedure for the treatment of multiple recession type defects makes it an preferable modality. Tarnow (1986) [12] suggested a semilunar approach in shallow single recessions.

CAF may be used in combination with other grafting materials such as connective tissue graft (CTG),[2] barrier membranes,[13] EMDs,[14] acellular dermal matrix (ADM)[15] or other. **Cairo et al. (2008)[16]** in a systematic review stated that the recession reduction in Miller's Class I and II recession defects and the probability of obtaining complete root coverage increases with the use of CTG and the enamel matrix derivative (EMD) in combination with CAF procedure.

The avascular nature of the root surface poses a great challenge in achieving complete root coverage of exposed root by hampering survival of the most graft. Accordingly, the difficulty is increased for the clinician with a wider area of root exposure.

Multiple adjacent recession type defects (MARTD) differs in localized recession type defects in many aspects. Not only the extensive avascular exposed root surface but certain anatomical factors such as thin biotype, decreased keratinized tissue width (KTW), root prominence and root proximity difficult the choice of surgical treatment used for the treatment of MARTD. Systematic reviews by **Roccuzzo et al. (2002)**[17], **Cheng et al. (2007)**[18] and **Oates et al. (2003)**[19] have extensively reviewed the outcome of the different treatment modalities used in the treatment of isolated gingival recession type defects. On the contrary, little scientific literature is available regarding treatment modalities used for treating MARTD.

The different techniques used in the treatment of MARTD include CAF[20] a supraperiosteal envelope technique in combination with CTG[21], or its evolution as a tunnel technique.[22] To reduce the morbidity of the technique, addition of biological factors such as; EMD[23,24] platelet rich plasma (PRP) [25], platelet rich fibrin (PRF)[26] have been suggested so as to increase the predictability of the root coverage treatment.

PRF membrane is a second-generation platelet concentrate emerging in the field of periodontics as a promising biomaterial. It contains platelets, growth factors and cytokines embedded in a fibrin network.[27] A strong architecture as a healing matrix with unique mechanical properties thus allowing release of growth factors for longer duration makes if distinct from other platelet concentrates. Also, easy and inexpensive method of preparation without addition of any anticoagulant agent makes it a favourable biomaterial. It has been utilized in the various periodontal surgery procedures to enhance bone regeneration and soft tissue wound healing.[28]

The success and predictability of the therapy depends on various patient related, dentist-related, site-related and technique-related factors. In a technical manner; flap thickness, flap tension before suturing and the position of the gingival margin (GM) at the end of the surgery appeared to be fundamental in achieving complete root coverage (CRC). Different suturing techniques have been used to place the gingival margin in the most coronal position. Aroca et al. (2010)[29] placed suspended sutures in the interproximal spaces held in the position with composite stops at contact point after coronally advancing the flap and Ozcelik et al. (2011)[30] added orthodontic buttons for suspending the sutures in the midbuccal area to maximize coronal positioning of flap.

At present, several methods are available for evaluating the soft tissue thickness. The use of needles and periodontal probes has been documented since the 1970s. To avoid the need for local anesthesia, non-invasive techniques involving ultrasonic devices and computed tomography (CT) have also been studied. However, these approaches have been criticized for either questionable reliability or additional radiation risk. On the other hand, the accuracy of cone-beam computed tomography (CBCT) for both soft tissue and bone thickness assessment in the maxillary anterior region has been confirmed, and a simple technique is introduced by Januário AL (2008)[31] for measuring the gingival tissue and dimension of dentogingival unit by CBCT.

The literature search revealed that there are few clinical studies that have been carried out to check the efficacy of CAF with PRF membrane. The preliminary results appear to be encouraging in terms of root coverage, and so, it was felt necessary to

further study this material in the treatment of MARTD. Also, CBCT is one of the latest methods of evaluation and till date there are no studies in the literature that have used CBCT for evaluating root coverage after CAF in gingival recession. So, the present study was planned to evaluate and compare the effectiveness of CAF with orthodontic button application with and without PRF membrane in the treatment of MARTD clinically and radiographically by CBCT.

AIM AND OBJECTIVES

The study was aimed to compare the effectiveness of CAF with orthodontic button application with and without PRF membrane in treatment of multiple gingival recession defects clinically & radiographically by CBCT.

Also, attached to this aim were certain objectives:

1) To assess the gingival root coverage obtained by CAF with orthodontic button application in multiple gingival recession defects.

2) To assess the gingival root coverage obtained by CAF with orthodontic button application in combination with PRF membrane in multiple gingival recession defects.

3) To assess and compare the change in the dimension of gingiva by CBCT at 6 months postoperatively in control and test groups.

4) To assess and compare the change in the dimension of gingiva by CBCT at 6 months postoperatively amongst control and test groups.

REVIEW OF LITERATURE

The ultimate goal of mucogingival plastic surgery is predictable and aesthetic root coverage. The goals of periodontal therapy include not only the arrest of periodontal disease progression, but also the regeneration of structures lost to disease where appropriate.

The regeneration of the tooth supporting structures which have been lost as a consequence of periodontal disease progression has been a somewhat elusive goal in periodontics. Although periodontal regeneration, i.e., the formation of new bone and new cementum with supportive periodontal ligament, is a possible objective of several

periodontal therapeutic modalities, outcomes of such modalities are not always predictable. Despite conclusive evidence that some regeneration may occur following regenerative procedures, complete regeneration may be an unrealistic goal for many situations due in part to the complexity of the biological events, factors and cells underlying successful periodontal regeneration.

Recently, surgical procedures aimed at greater and more predictable regeneration of periodontal tissues and functional attachment close to their original level have been developed, analyzed and employed in clinical practice for the treating gingival recession. Different surgical approaches include pedicle graft, laterally positioned grafts, CAF, FGG, SCTG and combination procedures. Among these procedures, the SCTG achieved the high success and predictability, combining the advantages of both the FGGs and the pedicle graft, however owing to the second surgical donor site and difficulty in procuring a sufficient graft in multiple recessions, various alternative additive membranes are used.

Among these procedures CAFs has been and is considered as one of the reliable method to obtain a predictable root coverage. The biologic foundation behind its use is that periosteum has long been viewed as a structure rich in osteoprogenitor cells. Thus root coverage is thought to result from a combination of the cellular activity of the periosteum and a barrier type effect by the repositioned periosteum. The post-operative level of the GM seem to play critical role in gaining the optimum percentage of root coverage hence to ascertain maximum coronal advancement of the GM suspended type of sutures were employed in this clinical trial with the help of orthodontic button.

Second generation platelet concentrate Choukroun's PRF had shown beneficial results in terms of periodontal regeneration.[27] Hence the efficacy of PRF membrane in combination with CAF was evaluated in this trial.

The assessment of regeneration following root coverage presents a challenge. Apart from clinical assessment, radiographic assessment is not possible as it does not show the soft tissue structure. With the development of recent technologies and techniques soft tissue can be assessed by using CBCT and thus the changes in the gingival tissue dimensions before and after the surgery are analysed in this study by this soft tissue CBCT.

For the ease of understanding, the review of literature has been segregated into following

parts:

1. Review of studies on CAF
2. Review of studies on CAF + Connective tissue graft (CTG)
3. Review of studies on CAF + Guided tissue regeneration (GTR)
4. Review of studies on CAF + PRF membrane
5. Review of studies on CAF + Orthodontic button
6. Review of studies on soft tissue evaluation using CBCT

Review of studies on CAF

Bernimoulin et al. (1975)[32] described the coronally positioned graft subsequent to grafting with a free graft (i.e. a two-stage procedure) due to unsatisfactory results of sliding flap and frequent lack of donor material associated with multiple gingival tissue. First, a free autogenous soft tissue graft was placed apical to an area of denuded root to increase the attached gingiva. After healing, the flap was coronally

repositioned. The requirements for the success of coronally positioned grafts he described include

(1) presence of shallow crevicular depths on proximal surfaces,

(2) approximately normal interproximal bone heights,

(3) tissue height within 1 mm of the CEJ on adjacent teeth,

(4) adequate healing of the free graft before advancing it coronally,

(5) reduction of any root prominence within the plane of the adjacent alveolar bone,

(6) adequate release of the flap to prevent retraction during healing.

The second-stage procedure used a split-thickness dissection with mesial and distal vertical releasing incisions until adequate flap mobility was obtained. The flap was sutured 0.5 to 1 mm coronal to the CEJ and not covered with a periodontal dressing. Finally the flap was firmly adapted to its seat with gauze and finger pressure for several minutes to promote adhesion. One, six and twelve months postoperatively recession depths were measured. Although significant correlation was found one month post-operatively, no significant differences were found in reduction of gingival recession by re-attachment one, six and twelve month post-operatively.

Tarnow (1986)[12] described the semilunar coronally positioned flap (CPF) technique. An incision was made that followed the curvature of the free marginal gingiva and extended into the papillae, staying at least 2 mm from the papilla tip on either side. The incision was made far enough apically to ensure that the apical portion of the flap rests on bone after repositioning. A split-thickness dissection of the flap was made and the flap is repositioned and held in place with light pressure and a periodontal

dressing. He treated around 20 defects with that technique and gained 2- 3 mm of root coverage in all of them.

The advantages of this technique included

(1) There was no tension on the flap after coronally repositioning it.

(2) There was no shortening of the vestibule.

(3) The papillae mesial and distal to the tooth being treated remained cosmetically unchanged.

(4) No sutures were needed because of the lack of tension of the tissue being coronally positioned.

The technique is indicated whenever there is gingival recession with minimal labial sulcus depth present. The procedure can also be used where there has been recession around previous full coverage restorations in the anterior section of the mouth.

Allen and Miller et al. (1989)[10] used single-stage CPFs in the treatment of shallow marginal recession. Thirty-seven sites in 28 patients having Miller class I defects with minimum 3 mm keratinized tissue apical to exposed root, with RD between 2.5 to 4 mm without loss of interdental bone or soft tissue were treated by this approach. GT of minimum 1 mm was estimated to require for the surgery which was evaluated subjectively. Gingival recession was recorded as the distance from CEJ to the gingival crest at the time of surgery, 3 months and 6 months post-operatively. Sulcus depth was recorded at the same times. All measurements were read to the nearest 0.5 mm utilizing a standard colour coded probe. The technique consisted of citric acid root treatment, a split-thickness flap extending into the vestibule, and surface gingivoplasty of the papillae to produce a bleeding bed. Care was taken to confine the

citric acid application to the root surface and not injure the marginal gingiva. Vertical incisions were made lateral to the recessed area beginning at a point apical to the papilla tip and extending well into alveolar mucosa. The alveolar mucosa between the two vertical incisions was then undermined by sharp dissection with undermining going well into the vestibule while remaining parallel with the surface. Next, a sulcular incision was used to reflect the coronal portion of the flap by sharp dissection close to the periostium until reaching the split thickness incision previously made in alveolar mucosa. A gingivoplasty of each papilla adjacent to the recession was then performed. This excision did not reduce the height of the papilla, but was designed to create a bleeding surface which served as a bed for the CPF. Suturing the two vertical incisions was completed before suturing the papillae to avoid stretching of the gingiva. Either 4-0 or 5-0 chromic gut suturing material was used. Flaps were sutured into position and dressed. The mean gain of root coverage was 3.17 mm at 3 months and 3.18 mm at 6 months postoperatively. CRC was attained in 84% of the sites, with a mean root coverage gain of 3.2 mm.

Zucchelli and De Sanctis et al. (2000)[20] introduced the CAF for multiple recessions as a novel approach to treat more than two adjacent teeth with gingival recession in patients with aesthetic demands. The patient population consisted of 22 young patients with atleast two adjacent gingival recession defects in aesthetic areas of mouth (from 15 to 25) which fell into Miller Class I or Class II category were taken up for this case series. This technique comprises an envelope type of flap (with no vertical releasing incisions); an innovative flap design that anticipates the rotational movement of the surgical papillae during the coronal advancement of the flap; a split (at the level of the surgical papillae) – full (at the soft tissue apical to the root

exposure) – split (apical to bone exposure) approach during flap elevation; a double incision (one to dissect muscle insertions from the periosteum and the other to cut muscle from the inner connective tissue lining the mucosa of the flap) to permit coronal advancement of the flap; the de-epithelization of the anatomic papillae; and a various number of sling sutures anchored to the palatal cingulum of the treated teeth. The clinical re-evaluation was done 1 year after the surgery. This case series reported 97.1 ± 5.1% mean root coverage and 88.6 ± 20.3% CRC. A stastistically significant increase in the keratized tissue was observed 1 year after surgery, this increase was inversely correlated with the amount of pre-surgical keratinized tissue. Greater reduction in recession depth were observed in the cases with worse initial conditions and with lesser amount of keratinized tissue apical to the recession defect.

Zucchelli G et al. (2009)[33] carried out a randomized clinical trial comparing CAF, with or without vertical releasing incisions, for the treatment of multiple recession type defects. Thirty two patients in the age range of 22 - 46 years with multiple gingival recession were included in this study. All participants had multiple (at least two) Miller Class I and II recession defects of ≥ 1 mm in depth on adjacent teeth in the same quadrant of the upper jaw with identifiable CEJ, step if present not more than 1 mm deep at CEJ level with an identifiable CEJ and ≥1 mm high keratinized tissue apical to the root exposure. Subjects smoking >10 cigarettes/day were excluded. Recession defects associated with demineralization/caries, deep abrasion, or restoration and teeth with evidence of pulpal pathology were not included. Molar teeth were also excluded. Patients were assigned to one of the two treatment groups using a computer-generated randomization table. CAF with vertical releasing incisions were adopted for control group and envelope technique for test group. CRC

was achieved in 35 of 45 (77.7%) control gingival defects and 42 of 47 (89.3%) test defects. Both these techniques did not report stastistically significant differences in terms of the mean percentage of root coverage between both approaches. However, the envelope type of CAF was associated with an increased probability of achieving CRC and with a greater increase of buccal keratinized tissue height. Patient satisfaction with aesthetics (overall satisfaction, colour match and amount of root coverage) was very high for both treatments, with no significant difference observed between them; better results, in terms of postoperative healing and aesthetic evaluation, as judged by an independent expert periodontist, were obtained for patients treated with the envelope type of CAF. Keloids, which may form along the vertical releasing incisions, were responsible for the worst aesthetic evaluation made by the expert periodontist.

Review of studies on CAF + CTG

Wennstrom et al. (1996)[34] in a 2 year prospective study tried to evaluate whether an increased thickness of the gingiva through the use of a free CTG, in conjunction with a CAF procedure, may positively influence the treatment outcome with respect to (i) root coverage and (ii) stability of the position of the soft tissue margin. 67 subjects (age range 19-38 years) with aesthetic or root hypersensitivity problems due to localized recession type defects of at least 3 mm at one or several teeth which fell under Miller Class I category were recruited for the study. The surgical technique utilized to achieve soft tissue root coverage was a CAF, with (test sites) or without (control sites) the placement of a free CTG under the advanced flap. Before (baseline) and at 6, 12 and 24 months after surgical treatment probing pocket depth, probing attachment loss as probing depth measured from the CEJ, RD as the distance between

CEJ and the soft tissue margin, gingival height as the distance between the soft tissue margin and the MGJ at the facial aspect of the tooth were recorded (to the nearest 0.5 mm) at the deepest point of the facial recession sites using a calibrated periodontal probe with a tip diameter 0.45 mm and 1 mm increments. 6 months following the root coverage procedure the mean RD had decreased to 0.2 mm in both the test and the control group. The average loss of probing attachment was reduced in the test group from 4.9 mm to 1.2 mm and in the control group from 5.1 mm to 1.5 mm, while the probing pocket depth remained shallow and essentially unchanged. Hence, the gain in probing attachment at 6 months amounted to 3.7 and 3.6 mm for test and control sites, respectively. CRC was observed at 72% of the test sites and 74% of the control teeth. The re-examinations performed 12 and 24 months after the surgical treatment did not reveal any major differences in the mean values for recession depth, gingival height or probing assessments from those at 6 months in any of the treatment groups, except for some further increase in gingival height in control sites. Thus, they concluded that both these techniques did not show any changes in terms of root coverage.

Carlvalho et al. (2006)[35] clinically evaluated the effectiveness and the predictability of root coverage at adjacent multiple gingival recessions using a modified CPF associated with the SCTG. Ten subjects, five males and five females, aged 24 to 36 years having at least two adjacent Miller Class I or II buccal gingival recessions (≥1 mm in depth) with detectable CEJ involving anterior or posterior teeth at upper or lower jaw with good systemic health and no restorations or caries in the area to be treated were enrolled. Each patient was treated using a modified CAF associated with the SCTG. Gingival recession depth, probing depth, CAL and apicocoronal width of keratinized tissue were measured at baseline and 6 months after surgery. A significant

gain in CAL (1.97 – 0.94 mm; P <0.0001) and increase in keratinized tissue (1.31 – 1.23 mm, P <0.0001) were observed. No statistically significant change from baseline was found for PD (-0.07 – 0.75; P>0.05). A decrease in the GRD (2.03 – 0.78 mm; P<0.0001) was obtained, which represented 96.7% of root coverage. CRC was found at 27 of the 29 defects (93.1%), and in nine of the 10 patients (90%). At most areas, an excellent colour match and aesthetic result were obtained. From the results the authors concluded that the modified CAF associated with a SCTG was effective and predictable in producing root coverage at multiple adjacent gingival recessions, resulting in 96.7% of root coverage, 93.1% of CRC, and a gain in CAL and width of keratinized tissue.

Pini Prato et al. (2010)[36] conducted a long-term study to compare the clinical outcomes of CAF alone versus CAF plus CTG in the treatment of multiple gingival recessions using a split mouth design over 5 years of follow-up. An envelope flap design was used to treat the recession defects as described by Zucchelli & De Sanctis in 2000.[18] A total of 13 patients requiring treatment of multiple recessions for aesthetics and/or dental hypersensitivity with at least two multiple bilateral Miller I, II and III recession defects in the maxillary arch without any clinical signs of active periodontal disease were treated by CAF and CTG on one side and by CAF alone on contralateral side. Recession depth, probing depth and CAL were the clinical parameters evaluated at baseline, 6-month, 1- and 5-year follow-up visits using a UNC 15 periodontal probe. In the CAF-treated sites, the baseline gingival recession (Rec 0) was 2.9 ± 1.3mm while the final gingival recession (Rec 5) was 0.8 ± 0.8 mm. CRC was observed in 57% of the sites at the 6- month follow-up, in 37% of the sites at the 12-month follow-up and in 35% at the 5-year follow-up. In the CAF + CTG

treated sites, the baseline gingival recession (Rec 0) was 3.6 ± 1.3 mm while the final gingival recession (Rec 5) was 0.4 ± 0.5mm. CRC was observed in 34% of the sites at the 6-month follow-up, in 45% of the sites at the 12-month follow-up and in 52% at the 5-year follow-up. This 5-year long-term clinical study detected no difference between CAF versus CAF + CTG at the 6- month follow-up in the treatment of multiple gingival recessions, CAF+CTG achieved better outcomes in terms of CRC than CAF at the 5-year follow-up. They observed a coronal displacement of the GM in the CAF+CTG-treated sites, while an apical relapse of the GM was noted in the CAF-treated sites between the 6-month and 5-year follow ups.

Zucchelli et al. (2014)[37] compared short and long-term root coverage and aesthetic outcomes of the CAF (CAF) alone or in combination with a CTG for the treatment of multiple gingival recessions. Fifty patients with multiple (≥2) adjacent gingival recessions (≥2 mm) in the upper jaw were enrolled. Twenty-five patients were randomly assigned to the control group (CAF), and the other 25 patients to the test group (CAF+CTG). Clinical outcomes were evaluated at 6 months, 1 and 5 years. The aesthetic evaluations were made 1 and 5 years after the surgery. All surgeries were performed by the same expert periodontist. The surgical technique adopted in the control recession defects was the envelope type of CAF proposed by Zucchelli & De Sanctis (2000)[20]. The same surgical approach was used in the test group with the only difference that a CTG was added. The CTG was derived from removing the epithelium with the blade of a palatal FGG; graft thickness did not exceed 1 mm. Surgical chair time was measured with a chronometer. No statistically significant difference was demonstrated between the two groups in terms of recession reduction and CRC at 6 months and 1 year. At 5 years, statistically greater recession reduction

and probability of CRC, greater increase in buccal keratinized tissue height and better contour evaluation made by an independent periodontist were observed in the CAF+CTG group. Better postoperative course and better colour match were demonstrated in CAF-treated patients both at 1 and 5 years. Hence, CAF+CTG provided better CRC at 5 years; keloid formation due to graft exposure was responsible for the worse colour match evaluation.

Skurska et al. (2015)[38] in a split mouth study compared the clinical and aesthetic parameters following a connective tissue graft (CTG) combined with the modified CAF (MCAF), or the CAF combined with vertical incisions (CAF) in the treatment of Miller class I and II recessions. Twenty patients with the total number of 99 recessions were treated in this study. The MCAF technique described by De Sanctis and Zucchelli[20] was performed on the right side (51 recessions). One month after the first surgery, a CAF with vertical incisions was applied on the left side (48 recessions). The clinical and aesthetic evaluation was executed. No statistically significant differences were found between the two sides in any evaluated parameter at the baseline examination. The mean root coverage on the MCAF side was 89.73% 3 months post-operative, 88.68% 6 months post-operative and 90.52% 1 year post-operative, whereas on the CAF side 95.48%, 93.87% and 91.77% respectively. The CRC was achieved in 40 of 51 (78.43%) gingival defects treated with MCAF and 40 of 48 (83.33%) gingival defects treated with CAF. The complete coverage of all recessions on the side treated with MCAF was obtained in 12 subjects (60%), whereas on the side treated with CAF in 15 subjects (75%). Over a period of one year, statistically significant reductions of GR values were achieved on both sides, after MCAF as well as CAF. GR values were reduced from 2.46 ± 0.73 mm to 0.25 ± 0.56

mm and from 2.53 ± 0.82 mm to 0.28 ± 0.65 mm on the MCAF and CAF side respectively. Also a significant decrease in RW values, from 3.50 ± 1.06 mm to 0.56 ± 1.22 mm on the MCAF side and from 3.20 ± 1.01 mm to 0.40 ± 0.94 mm on the CAF side was noted. There were no significant differences in both parameters between the MCAF and CAF sides in all post-operative examinations. After 1 year observation period, a significant increase in keratinized tissue (KT) and GT was noted on both sides, from 2.33 ± 0.88 mm to 3.66 ± 1.14 mm on the MCAF side and from 1.98 ± 0.78mm to 3.55 ± 0.95 mm on the CAF side or KT, and from 1.37 ± 0.39 mm to 2.10 ± 0.47 mm on the MCAF side and from 1.25 ± 0.35 mm to 1.96 ± 0.39 mm on the CAF side for GT. There were no differences in KT and GT between the two sides in any examination. The aesthetic results were evaluated on the basis of the root coverage aesthetic score system (RES). The average score for the MCAF side was 7.98 ± 1.88 (min 2, max 10) and 8.37 ± 1.81 (min 2, max 10) for the CAF side. There was no significant difference in the RES value or its variables between the two sides. Concluding remarks given by the authors were that the both MCAF with CTG and CAF with CTG allow obtaining a satisfactory and comparable root coverage as well as aesthetic outcome without the negative effect of vertical incisions on the appearance of soft tissue.

Cairo et al. (2016)[39] in a randomized clinical trial assessed the clinical efficacy of CAF with or without CTG for the treatment of MARTD in the upper arch. Thirty-two patients with a total of 74 gingival recessions were randomly allocated to the two groups. Outcome measures, collected by a blind examiner, included CRC recession reduction, keratinized tissue (KT) gain, increase in gingival thickness (GT), patient satisfaction RES. An interaction between treatment and baseline GT was detected. At

1 year, CAF+CTG resulted in better outcomes in terms of CRC (p=0.0016) and recession reduction than CAF alone at sites with thin gingiva (thickness ≤0.8 mm). No difference was found between CAF alone and CAF+CTG at sites with thick gingiva (>0.8mm). CAF resulted in higher aesthetic scores (RES) than CAF+CTG at sites with thick gingiva. CAF+CTG was associated with greater KT gain and greater post-operative morbidity. CTG under CAF results in increased probability of CRC only at sites with thin baseline gingiva. CAF alone is associated with similar clinical outcomes and better aesthetics at sites with thick baseline gingiva. An interaction between the type of treatment and baseline GT was demonstrated. CAF+CTG resulted in better outcomes in terms of CRC and recession reduction than CAF alone only at sites with thin periodontal biotype (thickness ≤0.8 mm). Hence use of CTG under CAF is strongly indicated at sites with keratinized tissue thickness ≤0.8 mm. Conversely, the use of CTG could be avoided at sites with KT thickness>0.8, where CAF alone was associated with similar clinical outcomes and better aesthetics than CAF+CTG.

Review of studies on CAF + GTR

Roccuzzo M et al. (1996)[40] evaluated the reliability of the bioresorbable barrier and non resorbable membrane in the treatment of human recession defects in terms of root coverage and clinical attachment gain. They selected twelve patients (9 males and 3 females) in the age range of 21 to 31 years with bilateral and similar isolated gingival recessions on both the maxillary canines. September 1993 to May 1994, using the split mouth design. Randomization for test and control treatment was performed by coin toss immediately prior to surgery. Six right and six left canines were used as test and the other 12 contralateral teeth as control. The surgical procedure at test and

control sites was identical. Two oblique releasing incisions were made so that a large trapezoidal combined full-thickness and split-thickness flap could be raised without involving the adjacent papillae. The full-thickness portion was limited to 3 to 4 mm beyond the marginal bone crest. The continuous partial-thickness portion extended apically into the vestibulum so that the flap could be easily repositioned as far coronally as needed. On the test sites matrix barrier of the most appropriate configuration was selected and trimmed in order to cover the exposed root portion and about 3 mm of the surrounding bone while on the control sites expanded polytetrafluoroethylene (ePTFE) membranes were placed. Following the application of test or control device, the flap was coronally positioned to completely cover the barrier and sutured, free from tension, by means of interdental interrupted sutures. The control membranes were surgically removed after 4 weeks. No periodontal dressing was applied at any of the surgical procedures. Immediately before surgery and at 6 months postoperatively, extension of gingival recession; i.e., distance from CEI to GM; probing depth; CAL and width of keratinized tissue were collected by the same examiner mid-buccally, by means of a William's probe, and rounded off to the nearest millimetre. At the test sites, gingival recession decreased from 4.75 ± 0.22 mm to 0.83 ± 0.24 mm, a reduction by 3.92 ± 0.31 mm, corresponding to a root surface coverage of 82.4 ± 5.1%. At the control sites, gingival recession decreased from 4.75 ± 0.22 mm to 0.75 ± 0.22 mm, a reduction of 4.0 ± 0.34 mm, a root surface coverage of 83.2 ± 5.2%. The changes were highly significant for both test and control treatment ($P<0.0001$), but there were no differences between treatments. The average clinical attachment gain, 4.33 ± 0.44 mm and 4.42 ± 0.48 mm at test and control sites respectively, was statistically significant ($P < 0.0001$), but again there

was no difference between treatments. This study concluded giving remark that the bioresorbable matrix barrier can be used in GTR treatment of recession defects with a high predictability of good results. They further stressed that the surgical technique and patient compliance are essential to the results.

Amarante et al. (2000)[41] examined the outcome of CAF in the treatment of Miller Class I and Class II gingival recessions with or without the supportive effect of a bioresorbable periodontal membrane. Twenty patients, 10 females and 10 males, with a mean age of 38.4 years in generally good health without contraindications for periodontal surgery were recruited for this study. Patient had bilateral buccal gingival recessions in cuspids and bicuspids in the upper or lower jaw presented with a probing depth of <3 mm with no bleeding on probing. One defect from each pair was randomly selected to be treated either by a CAF only or by CAF supported by a bioresorbable membrane. PPD, relative attachment levels, gingival recession, width of recession defect and width of keratinized tissue were evaluated at baseline as well as at 3 and 6 months after surgery. Among the 20 membrane sites, 1 stayed unchanged while 19 gained root coverage at 6 month examination. Among the non-membrane sites, all gained root coverage at 6 months and 10 sites (50%) showed complete coverage to the CEJ. The flaps in both treatment groups were coronally positioned as far as possible because of an anticipated recession during healing. Nevertheless, most of the membranes were slightly exposed already one week postoperatively. At 3 months the mean gain of root coverage was 2.7 mm in the membrane group and 2.6 mm in the non-membrane group. At 6 months, the extent of root coverage achieved at 3 months was slightly reduced in both groups, but this change was not statistically significant. Since there was no significant difference between membrane and non-

membrane group in terms of root coverage it was concluded that bioresorbable membrane underneath the flap does not seem to further improve the clinical results.

Lekenes KN et al. (2005)[42] compared 12-month and 6-year follow-up outcomes following CPF procedures in the treatment of Miller Class I and Class II gingival recessions with or without the adjunctive use of a biodegradable periodontal membrane. Twenty patients, 10 females and 10 males, with a mean age of 38.4 years were recruited for this study. Among the 20 subjects, 12 were non-smokers (five men and seven women) and eight were heavy smokers (five men and three women). Inclusion criteria required that the paired defects had a recession of ≥ 3 mm measured from the CEJ to the free GM, conformed to the Miller Class I or Class II, and presented with a probing depth of < 3 mm with no bleeding on probing. One defect from each pair was randomly selected to be treated either by a CPF only, or by a CPF supported by a biodegradable membrane. Gingival recession, relative attachment level measured mid-buccally with the disc located at the buccal cusp/incisal edge, width of the recession defect measured by the manual probe across the buccal surface at the CEJ level, width of keratinized gingiva measured by the manual probe from the GM to the MGJand probing depths at the middle of the buccal surfaces measured by an automated pressure sensitive probe were evaluated at baseline and at 3, 6 and 12 months post operatively and then yearly. Individual patient data for the 11- patient sample demonstrated that from 12 months to 6 years regardless of smoking six membrane sites lost root coverage, four sites stayed unchanged, and one site gained 1 mm root coverage. Among the 11 non-membrane sites, seven sites lost root coverage, and four sites stayed unchanged. An interesting observation was that stable sites with total root coverage at 6 years were stable for membrane and non-membrane sites

within the same patients while unstable sites showed relapse on both sides. At 6 months the mean gain of root coverage was 2.1 mm in the membrane group ($p < 0.001$) and 2.3 mm in the non-membrane group ($p<0.001$). By 12 months the extent of root coverage achieved at 6 months was maintained for the membrane sites, while reduced by 0.1mm for the non-membrane sites. They concluded that placement of a biodegradable membrane underneath the flap does not seem to improve neither the short-term nor the long-term results.

Banihashemrad A et al. (2009)[43] evaluated a GTR treatment using a bioabsorbable membrane in conjunction with a CAF to treat Miller's Class I and Class II gingival recession defects. A split-mouth design was used in the study. The patients were required to be nonsmokers, have full-mouth plaque score of less than 15% and not have received any medication known to interact with periodontal treatment during the past six months. The two recession defects, among the bilateral facial gingival recessions of Class I or II, were randomly assigned to receive either the test or control treatments using a coin toss. each of the test patients, one recession defect was treated using a GTR collagen membrane in conjunction with a CAF (GTR+CAF).In each of the control patients, the recession defect was treated using the CAF alone. Clinical parameters were measured to the nearest millimetre using a William's periodontal probe. These included visible recession i. e. distance between CEJ to GM, probing pocket depth, keratinized gingiva width, horizontal width of recession defect at the CEJ and CAL. These measurements were repeated in both groups after six months. None of the membranes was exposed at the recall visits following surgery. There were significant improvements of 3.00 ± 0.36 mm. (mean ± standard error of the mean) ($P<0.001$) and 2.00 ± 0.27 mm. ($P<0.001$) in the GTR+CAF and CAF groups,

respectively. These corresponded to root coverages of 67.88% ± 0.07% and 57.42% ± 0.09%, respectively. The difference in the improvements was statistically significant (P=0.013). There were improvements of 0.73 ± 0.14 mm. and 0.36 ± 0.20 mm. (P=0.1) in the GTR+CAF and CAF groups, respectively. The difference between the two groups was not significant (P=0.17). There were mean keratinized widths of 3.73 ± 0.30 and 4.09 ± 0.12 mm. in the test group before and six months after treatment, respectively (P=0.22). In the control group, corresponding figures were 3.91 ± 0.29 and 3.73 ± 0.27 mm respectively (P=0.44). The difference in the attachment gain of the two groups (1.36 ± 0.36 mm) was statistically significant (P=0.004). Authors found positive results and thus concluded that the use of bioresorbable collagen membrane in conjunction with CAF could be successfully and predictably used to treat Miller's Class I and Class II gingival recessions.

Chakraborthy S (2015)[44] clinically evaluated and compared the effectiveness of amnion and chorion allografts in combination with CAF in the treatment of gingival recession. Twelve patients of mean age 33.75 ± 6.89 having at least 2 bilateral Miller's Class I or Class II gingival recession were recruited. They were grouped as Group I- 12 recession defects treated with amnion allografts along with CAF and Group II- 12 recession defects treated with chorion allografts along with CAF. Clinical parameters such as gingival Index, plaque index, length of the recession, width of the recession, width of keratinized gingiva, relative attachment level were evaluated at baseline, 3 and 6 months post-surgery. The involved site was randomly assigned either to the CAF with Amnion membrane (AM) or to the CAF with Chorion membrane (CM). Twenty four recession defects of which 12 recession defects were treated with amnion allografts along with CAF and 12 recession defects treated with

amnion allografts along with CAF. In group I from baseline to 1 month, 3 months and 6 months with respect to length of recession (p=0.001,0002,0.002) width of recession (p=0.003,0.002,0.002) statistically significant reduction was observed and significant gain was seen with width of keratinized gingival (p=0.002,0.002,0.002). Similarly intra group analysis for group II from baseline to 1 month, 3 months and 6 months with respect to length of recession (p=0.001,0001,0.002) width of recession (p=0.002,0.002,0.002) statistically significant reduction was observed and significant gain was seen with width of keratinized gingival (p=0.001,0.001,0.001). Intergroup comparison for length of recession showed statistically significant difference in both the groups at 1 month (p=0.038) relating to mean gain of root coverage but no significant differences seen in both the groups at 3 months and 6 months. Comparison of two groups with respect to width of recession statistically significant difference was seen in both the groups at 3 months (p=0.001) relating to reduction in width of recession and also at 6 months (p=0.001). There was increase in the width of keratinized gingiva in both the groups. Authors found both amnion and chorion allografts to be promising novel tissue engineered biomaterials, they also added that rich source of stem cells, enhancement of healing and self-adhering property make these membranes an effective option for root coverage procedures.

Review of studies on CAF + PRF

Cheung and Griffin et al. (2004)[45] performed a randomized clinical trial were to assess the clinical efficacy of platelet concentrate grafts (PCG) in the treatment of Miller Class I or II buccal gingival defects and to compare their soft tissue healing with those of SCTGs (SCTG). Seventeen arches in 15 patients with bilateral gingival recessions were treated with SCTG and PCG covered by CAFs. PCG was prepared 30

minutes before starting surgery, by drawing 54 ml of blood from each patient. The collection of autogenous platelet concentrate was performed. An extra 4 ml of platelet poor plasma (PPP) was aspirated in order to give a higher concentration of PCG. Two layers of properly trimmed collagen sponge were used as a carrier. SCTG were harvested from palate. The grafts were placed over the denuded roots and stabilized by continuous sling sutures utilizing the 5-0 bioabsorbable polyglactin material. Vertical recession depth (VRD), CAL, PD, and KTW were measured preoperatively and 8 months postsurgery. No statistically significant differences were found in preoperative measurements between groups except for KTW. There was a statistically significant reduction in VRD and gain in CAL for both groups at 8 months postoperatively. For the SCTG group, VRD reduced significantly from 2.48 ± 0.62 mm preoperatively to 0.17 ± 0.25 mm postoperatively, and for the PCG group from 2.43 ± 0.62 mm to 0.48 ± 0.54 mm. CAL reduced significantly from 3.61 ± 0.57 mm preoperatively to 1.97 ± 0.70 mm in the SCTG group and from 3.48 ± 0.58 mm to 1.53 ± 0.39 mm in the PCG group. The average percent of coverage was 95% for the SCTG group and 80% for the PCG group. Nineteen of the 29 teeth in the SCTG group achieved complete coverage (65.5%), while 15 out of 25 teeth in the PCG group achieved complete coverage (60%).The results remained stable for 8 months. They found platelet concentrate graft as an alternative graft material for treating gingival recession which may result in better aesthetic appearance.

Huang et al. (2005)[25] in a randomized, controlled pilot trial evaluated the role of PRP in CAF root coverage procedures. Inclusion criteria for this trial was 1) systemically healthy subjects; 2) non-smokers; 3) patients who were willing to comply with all study-related procedures; 4) ≥18 years old; 5) ability to maintain good oral hygiene;

6) maxillary or mandibular incisors, canines, or premolars with Miller's Class I (confirmed by radiographic analysis of the involved tooth) facial gingival recession; 7) GT ≥0.5 mm as measured 2 mm apical to the GM; 8) width of keratinized gingiva ≥2 mm; and 9) RD ≥2 mm. The exclusion criteria was determined as: 1) previous surgical attempt to correct the gingival recession; 2) long-term (>2 weeks) use of antibiotics in the past 3 months; 3) known allergies to the materials used; 4) subjects with compromised healing potential; 5) subjects with active infectious diseases (hepatitis, tuberculosis, HIV, etc.; 6) patients taking steroids or medications known to cause gingival enlargement; and 7) pregnant or attempting to become pregnant. Twenty-four systemically healthy patients participated in this study who fulfilled all the inclusion and exclusion criterias. A single Miller's Class I buccal recession defect per patient was treated. These patients were randomly assigned into CAF or PRP + CAF groups. Clinical parameters included RD, RW, GT, KTW, CAL, PD, PI, GI and wound healing index. PRP was prepared from whole blood drawn prior to surgery and applied to root surfaces. Patients were followed at 2, 4, 12, and 24 weeks post-surgery. Twenty-three patients completed the study. The RD at 24 weeks was significantly reduced from 2.9 ± 0.5 to 0.5 ± 0.6 mm in the CAF group ($P < 0.05$) and from 2.8 ± 0.2 to 0.5 ± 0.7 mm in the PRP + CAF group ($P < 0.05$). The mean root coverage was 83.5% ± 21.8% in the CAF group and 81.0% ± 28.7% in the CAF + PRP group ($P > 0.05$). Fourteen out of 23 patients (60.9%) experienced 100% root coverage at the 24-week postoperative follow-up. Based on the results of this pilot study he made a statement that the application of PRP in CAF root coverage procedure provides no clinically measurable enhancements on the final therapeutic outcomes of CAF in Miller's Class I recession defects.

Aroca et al. (2009)[26] in a randomized controlled clinical trial compared modified CAF surgery alone or in combination with PRF to evaluate whether addition of the PRF would improve the clinical outcome for the treatment of multiple gingival recessions. In this study twenty subjects, presenting three adjacent Miller Class I or II multiple gingival recessions of similar extent on both sides of the mouth, were enrolled. The mean recession value at baseline was 2.9 – 1.1 mm for test sites and 2.5 – 0.9mmfor control sites. Each patient was treated on both sides by an MCAF technique; the combination treatment (with a PRF membrane) was applied on the test side. PD, RW, CAL, KTW and GT were measured at baseline and at 6 months post-surgery. Gingival recession was measured at baseline and at 1, 3, and 6 months post-surgery. Differences between the two groups were statistically significant at 3 and 6 months. Mean root coverage after 1, 3, and 6months was 81.0% – 16.6%, 76.1% – 17.7%, and 80.7% – 14.7%, respectively, at the test sites and 86.7% – 16.6%, 88.2% – 16.9%, and 91.5% – 11.4%, respectively, at the control sites. At 6 months, CRC was obtained at 74.6% of the sites treated with the control procedure but at only 52.2% of the experimental sites. At 6 months, the increase in GT was statistically significant when comparing the test sites (from 1.1 – 0.3 mm at baseline to 1.4 – 0.5 mm at 6 months) to the control sites (from 1.1 – 0.3 mm at baseline to 1.1 – 0.3 mm at 6 months). In the case of PD, there was no significant difference between the two groups at 6 months, but a significant CAL gain in favor of the control group was observed at that time. This controlled, randomized trial for the treatment of multiple gingival recessions indicated that CAF surgery alone or in combination with PRF are effective procedures to cover denuded roots and the 6-month data comparing a combined CAF-PRF technique to CAF alone showed no additional benefit in terms of

mean root coverage or short-term wound healing for the treatment of multiple gingival recessions.

Jankovic et al. (2012)[46] in a 6-month randomized controlled clinical study primarily compared the results achieved by the use of a PRF membrane or CTG in the treatment of gingival recession and also evaluated the clinical impact of PRF on early wound healing and subjective patient discomfort. 15 systemically healthy patients which consisted of 5 men and 10 women between 19 and 47 years of age with presence of either bilateral isolated or multiple defects with recession depths greater than or equal to 2 mm when measured from the CEJ on anterior teeth or premolars, all defects judged as Miller Class I or II, were treated in treated in this study. The selected teeth were vital, free of restorations or with restorations removed, and with no bleeding on probing. One calibrated examiner blinded to the surgical treatment collected the data at baseline and 6 months postoperative. Randomization for test and control treatments was performed using a coin toss. All 15 patients received bilateral surgical treatment of gingival recessions. On one side, the gingival recession was treated with a CAF and PRF membrane (PRF group). The other side was treated with a CTG in combination with a CAF (control). The outcomes of this study revealed that both techniques, either a CTG or PRF membrane covered by a CPF, are effective in the treatment of gingival recession defects with significant root coverage (91% and 88%, respectively) and clinical attachment gain 6 months postoperatively. CRC was obtained in 75.85% of cases in the PRF group and 79.56% of cases in the control (CTG) group. This study demonstrated that there were no statistically significant differences in PD or CAL recorded between the two groups. CAL showed significant attachment gain for both groups. For the PRF group, the mean gain was 2.87 mm, and for the control group, it

was 2.96 mm. KTW was statistically enlarged for both groups, averaging 0.88 mm and 1.44 mm in the PRF and control groups, respectively. Results of this study indicated that use of a CTG is a highly effective method for root coverage. A high level of observed clinical parameter equivalence between CTG and PRF groups powerfully supports the clinical value of PRF use. Use of a PRF membrane in gingival recession treatment provided acceptable clinical results, followed by enhanced wound healing and decreased subjective patient discomfort compared to CTG-treated gingival recessions.

Uraz et al. (2013)[47] assessed the effectiveness and the predictability of PRF membrane (PRFM) with CAF for the treatment of MARTD, and compared it with expanded mesh connective tissue graft (e-MCTG). A total of 106 buccal gingival recessions were treated in 15 individuals (9 men, 6 women) complaining of aesthetic problem or dentinal hypersensitivity with Miller Class I or II defects were enrolled for this study. Clinical measurements recorded at baseline and 6 months after surgery included plaque index and gingival index, probing depth, recession depth, recession width, apico-coronal width of keratinized tissue, and CAL. At 6 months, both treatments resulted in significant improvements in the percentage of RC compared with baseline values. The sites treated with (CAF) + (PRF-M) had a mean RC of 95%. For (CAF) + (e-MTCG), the mean RC was 96.1%. A greater and statistically significant reduction in recession width was achieved at 6 months with both treatments. There were no significant differences in CAL between the two groups at baseline and 6 months after surgery. Group (CAF) + (PRF-M) had a statistically significant change in KT (4.2 to 5.2) and CAL (5.6 to 1.6). Group (CAF) + (e-MCTG) had a statistically significant change in KT (4.26 to 5.6) and CAL (4.43 to 1.1). The

results of this study indicated that both e-MCTG and PRF-M are effective and predictable treatment modalities for the management of multiple recessions-type defects in terms of RC, increase in keratinized tissue, and gain in CAL. Furthermore, PRF-M can be used successfully in the treatment of multiple recessions.

Gupta et al. (2015)[48] clinically evaluated and compare the efficacy of CAF alone and in combination with PRF membrane in the treatment of Miller Class I and II gingival recessions. Twenty‐six systemically healthy patients with isolated Miller Class I and II gingival recessions in Maxillary anterior and premolar teeth were included in the study. Presence and absence of plaque and bleeding on probing were noted. RD was measured from the CEJ to the apical extension of the GM (gingival zenith). PPD was measured from the GM to base of the gingival sulcus. CAL was measured from CEJ to the base of the gingival sulcus. Keratinized tissue height (width of keratinized gingiva) was measured from the GM to the mucogingival line. All these measurements were performed with the help of William's periodontal probe. Clinical measurements were taken immediately before surgery (baseline) and at 3 and 6 months follow‐up visits. Mean percentage root coverage was 91.00 ± 19.98% and 86.60 ± 23.83% for test and control group respectively. Difference between the groups in all parameters at baseline, 3 months and 6 months was non-significant. CRC was obtained in 12 (80%) and 11 (73.3%) subjects in test and control group respectively. The difference was found to be non-significant. Both groups showed significant differences in all parameters at 3 and 6 months respectively except difference in gingival tissue thickness which was non-significant in control group at 3 months. Combination of PRF to CAF procedure did not provide any added advantage in term of recession coverage in Miller class I and II recessions.

Review of studies on CAF + Orthodontic button

Ozcelik O et al. (2011)[30] in a randomized, controlled clinical trial tried to investigate the effectiveness of a new treatment approach, which consisted of CAF procedure combined with orthodontic button application (CAF+B) for the treatment of multiple recession-type defects in patients with aesthetic demands. Forty-three systemically and periodontally healthy subjects, 19 males and 24 females, aged 22–48 years (mean age, 38 years), presenting atleast three adjacent Miller Class I or II multiple gingival recessions affecting adjacent teeth of the upper jaw were enrolled in the study. The randomization was achieved by toss of a coin before the surgery of each patient. The number of the patients treated with the test and control procedures were 22 (81 defects; 42 Miller I and 39 Miller II) and 21 (81 defects; 40 Miller I and 41 Miller II), respectively. All participants met the study inclusion criteria: multiple (at least three) Miller Class I and II recession defects (≥ 2 mm in depth and ≥ 2 mm in width) on adjacent anterior (47 incisors in test and 52 incisors in control) or posterior teeth (34 pre-molars in test and 29 premolars in control) in the same quadrant of the upper jaw; presence of identifiable CEJ (in case of unidentifiable CEJ a resin stent was used as reference point); presence of a step ≤ 2mm at CEJ level and/or the presence of a root abrasion; presence of ≥ 1mm high keratinized tissue apical to the root exposure; presence of ≥ 0.8 mm thick gingival tissue (GT was measured at the mid-buccal 2 mm apical to the free GM by penetrating a UNC probe into the tissue and recorded to the nearest 0.5 mm). In both test and control groups, an initial periodontal therapy consisted of oral hygiene instructions, ultrasonic instrumentation and coronal polishing was done 1 month before surgery. Before surgery (after initial treatment, baseline) and 6 months after surgery clinical parameters were recorded. The surgical

technique applied in the test recession defects was the CAF combined with orthodontic buttons without vertical incision while CAF procedure without orthodontic buttons were performed on the test side. All surgical procedures were performed by the same experienced periodontist. No statistical difference was observed between groups for PPD, GRD, gingival recession width (GRW), CAL and KTW measurements at baseline. Statistically significant differences of GRD and CAL between baseline and 6 months were observed within each group ($p<0.0001$ and $p<0.001$, respectively). Forty-seven of the 78 defects in CAF (61%) and 66 of the 77 defects (84.6%) in CAF1B group exhibited CRC. Patient satisfaction with aesthetics was very high in CAF1B group when compared with CAF group. The results showed that the usage of the orthodontic buttons and suspended sutures with CAF technique was effective in treating multiple adjacent type gingival recessions. The 6 months results of the present study were very promising in terms of both clinical (root coverage, aesthetics, keratinized tissue height) and patient centered (immediate post-operative pain, aesthetics) parameters.

Khobragade S et al. (2016)[49] in order to achieve and protect the most possible coronal position of the GM in immediate postoperative phase with periodontal plastic surgery method applied orthodontic buttons in a randomized controlled clinical trial. Twenty systemically and periodontally healthy patients with bilateral Millers Class I and II multiple gingival recession defects with ≥1 mm of attached gingiva and probing pocket depth ≤3 mm at gingival recession sites were included in this study. Clinical recordings were performed at baseline, 2, 4, and 6 months after surgery with UNC 15 periodontal probe by a single examiner. CAF with orthodontic button application were performed on the test side to place suspended suture around the

buttons, while on the contralateral side which was the control side only CAF (without orthodontic button) were performed. Two‑way repeated measures of ANOVA reveal statistically significant difference in GRD, CAL, and KTW when compared between baseline and 2, 4, and 6 months of follow‑up. Test group exhibited more root coverage than control group and this difference in root coverage was statistically highly significant ($P < 0.0001$). Similarly, in test group, the final position of GM was more coronal to CEJ as compared to control group. The RES score for control group was 7.57 ± 1.75 and for test group was 8.76 ± 1.56. This difference was found to be statistically highly significant ($P < 0.001$) showing better aesthetic outcomes in test group. Looking at the results the authors reached to the conclusion that both the treatment modalities, i.e., CAF and CAF+B, were effective in treatment of Miller's Class I and Class II multiple gingival recession defects and CAF+B showed significantly better results in terms GRD reduction, CAL gain and aesthetic outcome of patients at 6 months, compared to CAF alone. The placement of GM and its stabilization during early healing stages appears to have a profound influence over the root coverage as well as the aesthetic outcome achieved in such procedures.

Review of studies on soft tissue evaluation using CBCT

Januario et al. (2008)[31] developed a soft tissue cone beam computed tomography (ST-CBCT) to improve soft tissue image quality and allow the determination of the dimensions and relationships of the structures of the dentogingival unit. Two separate CBCT scans were obtained from three patients with different periodontal biotypes. The first was a scan following standard methods; however, for the ST-CBCT the patients wore a plastic lip retractor and retracted their tongues toward the floor of their mouths. With the first scan, only measurements of the distance of the CEJ to the facial

bone crest, and the width of the facial alveolar bone were possible. In contrast, ST-CBCT allowed measurements of the distance of the GM to the facial bone crest, the GM to the CEJ, and width of the facial gingiva. A marked difference could be noted in terms of clarity of the images and ease of identifying structures when the two scans were compared. By retracting the soft tissues of the lip, cheeks, and tongue away from the gingiva in both facial and palatal aspects, there was an evident dark space created between these structures. This dark space was not present on the image of the first scan because it was occupied by the lip and cheek that collapsed onto the facial gingiva and prevented the clear visualization of the facial gingival tissue. Likewise, the tongue placed lower toward the floor of the mouth allowed a clear visualization of the palatal gingiva. ST-CBCT scans allowed a clear visualization, measurement of the dimensions, and analysis of the relationship of the structures of the periodontium and dentogingival attachment apparatus. These measurements were performed on the facial aspect of the tooth parallel to the long axis of the same tooth. The thickness of the facial bone (first scan) and facial GT (second scan) were also measured They described a novel, noninvasive, and powerful method to obtain clinical data regarding the dimensions and relationship of several structures of the periodontium and dentogingival attachment apparatus which will certainly aid clinicians in the planning and execution of a number of procedures in dentistry with increased predictability.

Barriviera M et al. (2009)[50] developed a method based on CBCT technology to consistently visualize and precisely measure the dimensions of the palatal masticatory mucosa. Thirty-one patients (11 males and 20 females), ages ranging from 19 to 53 years (mean age of 32 years), were selected for this study. The patients presented all maxillary teeth, except the third molars, and the exclusion criteria were: to have

undergone surgery for soft tissue removal in the area analysed, history or presence of pathology in the palatal region, teeth with severe morphological alterations, tooth mal-alignment and bone or gingiva loss seen in the CT scans. At the time of the CT scans, the patients remained seated and had their chins and heads stabilized. Each patient was asked to bite a wooden spatula placed across the mouth at the level of the maxillary and mandibular molars (first and second molars). The purpose of the spatula was to separate the maxillary teeth from the mandibular teeth and to prevent the tongue from touching the soft and hard palates during image acquisition. Together with the wooden spatula, a plastic lip retractor was placed in the patient's mouth so that the cheeks did not touch the facial aspects of the teeth, thus also allowing the facial gingiva to be visualized. All analyses were performed by the same radiologist as follows: canines, pre-molars and molars (five teeth on the right side and five teeth on the left side) were subjected to measurements. These measurements were performed at four different heights in the palate, i.e., at distances of 2, 5, 8 and 12mm from the GM. Therefore, four measurements were performed for each tooth. Retraction of the lips and cheek allowed a clear observation and measurements of the thickness of the palatal masticatory mucosa. The average thickness of the palatal mucosa was 2.92 mm in the canine area, 3.11 mm at the first pre-molar, 3.28 mm at the second pre-molar, 2.89 mm at the first molar and 3.15 mm at the second molar. Statistical differences were observed at different ages and heights of measurements. a new non-invasive method to consistently obtain images and measurements of the palatal mucosa is described. This reliable, simple and reproducible method could provide important benefits in planning dental procedures, especially in periodontics, implant dentistry and oral surgery.

Jia-Hui Fu et al. (2010)[51] in an attempt to check the relationship between underlying bone morphology in the maxillary anterior region performed a study. Twenty-two fresh frozen cadaver heads (from 16 white males and six white females; mean age: 67.6 years; age range: 33 to 97 years) were used for this investigation. They were washed and soaked in an antibiotic solution before they were frozen. Prior to the measurements, the heads were thawed overnight. Tissue biotypes were assessed clinically and radiographically with CBCT scans. Maxillary anterior teeth were atraumatically extracted. Two examiners measured the soft tissue thickness, alveolar bone thickness, probing depths, and GR at the mid-labial and palatal sites of the selected teeth. The thickness of both soft tissue and bone were measured using a caliper to the nearest 0.1 mm by two calibrated examiners. CBCT scans of the cadaver heads were taken to obtain radiographic measurements of the thickness of both soft tissue and underlying bone. The thickness of both soft and hard tissue were measured at 2.0 mm below the alveolar bone crest and perpendicular to the inner cortical plate of the tooth socket using the cross-sectional views taken at the midline of the selected teeth. No statistically significant differences were observed between the clinical and CBCT measurements of both soft tissue and bone thickness except the palatal soft tissue measurements. The labial GT was moderately associated with the underlying bone thickness measured with CBCT ($P < 0.05$). Gingival recession was not associated with the thickness of both labial gingiva and bone. Thus, this study demonstrated that the clinical measurements of labial gingiva and bone thickness correspond to radiographic measurements, thereby showing that CBCT could be used to determine both soft and hard tissue thickness.

Andres Pascual La Rocca et al. (2012)[52] conducted a study to determine the relationship between GT and width with respect to the underlying bone thickness in the maxillary and mandibular anterior sextant. A total sample of 180 teeth were included in this study: 90 maxillary (30 canines, 30 lateral incisors, and 30 central incisors) and 90 mandibular (30 canines, 30 lateral incisors, and 30 central incisors) from 15 patients (8 men and 7 women) between the ages of 22 and 49 years (mean age 29.53 years). All patients received a full dental prophylaxis and oral hygiene instructions 1 week before the clinical examination to control any signs of gingival inflammation. For the transgingival probing, a cheek retractor was used, and topical anaesthesia (lidocaine 4% cream) was applied over the area of examination. Measurements were taken piercing the tissue perpendicular to the tooth axis with a 10 endodontic file, which had a rubber stop. On removal, the thickness of the soft tissue was measured with a digital caliper. The GT was measured at 3 locations: (1) the GM 1 mm apical from the facial PD, (2) most apical, which was 1mm coronal from the mucogingival junction, and (3) mid located in a midpoint between the 2. All measurements were rounded to the nearest 0.2 mm. In addition, the apicoincisal gingival width was recorded. The CBCT examination was obtained. Axial slices (thickness of 1.0 mm) were adapted to follow the long axis and pass through the center of the root of each examined tooth. The CEJ was previously located, and the thickness of the facial bone wall was measured in 3 locations: crestal, which was located 4 mm apical to the CEJ; apical located at the apex of the root; and mid, which is located in a midpoint between the two. Clinical and cone beam CT measurements were compared and correlated. No statistically significant relations were observed between GT and bone thickness measures at any of the 3 positions. The mean GT at

crestal mid and apical position for the maxillary teeth was 1.01 (±0.58) mm, 1.06 (±0.48) mm, and 0.83 (±0.47) mm, respectively, and the corresponding mean bone thickness was 1.24 (±0.90) mm, 0.81 (±0.33) mm, and 2.78 (±1.62) mm, respectively. The GW is directly related (R=0.007; P<0.05) to the crestal bone thickness. In this study no direct correlation between GT and bone thickness could be established. However, positive evidence associating the crestal bone thickness and the apicoincisal width of gingiva was observed.

Faris Younes et al. (2015)[53] performed a study to determine the relationship between buccal bone and soft tissue thickness at premaxillary teeth by means of non-invasive and accurate registration methods. Buccal bone thickness at central incisors, lateral incisors and canines was measured at five reference points (1–5 mm from the top of the alveolar crest) on CBCT scans of 21 patients. The corresponding buccal GT was measured by the use of an ultrasonic device. Spearman's correlation coefficient was calculated to assess the correlation between buccal bone and soft tissue thickness at each tooth type. Mean buccal bone thickness (SD) at central incisors, lateral incisors and canines was 1.07 mm (0.34 mm), 1.16 mm (0.54 mm) and 0.98 mm (0.37 mm), respectively. For central incisors, 68% of all sites had a thickness <1 mm and 32% had a thickness between 1.0 and 2.0 mm. At lateral incisors, 44% demonstrated buccal bone thickness between 0 and 1.0 mm, 48% between 1.0 and 2.0 mm and 8% ≥2 mm. For canines, 57% of the sites were <1 mm thick; 41% were between 1.0 and 2.0 mm thick, and 2% demonstrated ≥2 mm thickness. Mean GT (SD) at central incisors, lateral incisors and canines was 1.37 mm (0.32 mm), 1.33 mm (0.32 mm) and 1.08 mm (0.25 mm) respectively. The correlation between buccal bone and soft tissue thickness was moderately positive (q=0.406; P<0.001). From the results, it was

concluded that a thin buccal bone wall (<1 mm) may be expected in over half of the central incisors and canines. The correlation between buccal bone and soft tissue thickness was moderately positive.

Mallikarjun S et al. (2015)[54] assessed and compared the thickness of gingiva in the anterior maxilla using radiovisiography and cone beam CT and its correlation with the thickness of underlying alveolar bone. Ten male volunteers aged 20–45 years with proper alignment of dentition in the anterior maxilla without the presence of any caries, cervical abrasions or restorations were included in the study. Subjects, who underwent crown lengthening procedures and periodontal plastic surgery, in the anterior maxilla and orthodontic treatment, were excluded. Pregnant women and smokers were also excluded from the study. The selected subjects had to undergo both clinical and radiographic examination. The measurements were made for the maxillary right central incisor (index tooth). Clinical examination included the identification of mucogingival junction, and the assessment of the width of keratinized gingiva using UNC‐15 probe. This was done by measuring the distance from the free GM of the index tooth (on the mid‐labial aspect) to the mucogingival junction. Radiographic examination included the use of both RVG by paralleling technique and CBCT. The thickness of gingiva was measured at 4 different levels: At the crest of alveolar bone, 1 mm apical to the crest, at midpoint between the alveolar crest and the MGJ and at the mucogingival junction. Similarly, the alveolar bone thickness was measured at the crest, 1 mm apical to the crest, at the midpoint between alveolar crest and mucogingival junction, and at the mucogingival junction. No statistically significant differences were obtained in the measurement made using RVG and CBCT. The results of the present study also failed to reveal any significant

correlation between the width of gingiva and the alveolar bone in the maxillary anterior region. Authors concluded that both CBCT and RVG can be used as valuable tools in the assessment of the soft and hard tissue dimensions.

Amid R et al. (2017)[55] assessed the relationship between facial gingival and bone dimensions in maxillary anterior teeth region using cone beam computed tomograph. This study assessed 621 maxillary anterior teeth in 144 patients. In the sagittal plane, facial bone thickness and GT were measured at the crestal level and at 2, 4 and 6 mm apical to the CEJ. The dentogingival complex dimensions and the distance from the CEJ to bone crest were also measured on cone beam computed tomograph scans. To determine the gingival biotype, GT at 2 mm apical to the GM was measured and GT <1.5 mm was categorized as thin while GT ≥1.5 mm was categorized as thick. The data were analyzed using SPSS version 21 via repeated measures ANOVA and the Cochrane's Q, chi-square and independent samples t-tests. The bone thickness around the maxillary central and lateral incisors and canine teeth at 4 and 6 mm apical to the CEJ was significantly different in thick and thin gingival biotypes ($P<0.05$). The mean GT at 2 and 4 mm apical to the CEJ was significantly different around central and lateral incisors ($P<0.05$). Thickness of crestal bone was significantly different between the two gingival biotypes around central and lateral incisors ($P<0.05$). Since CBCT scans are taken routinely prior to implant treatment for bone assessment, soft tissue assessment can also be done simultaneously and non-invasively by using a retractor or asking the patients to pucker their lips and blow out their cheeks during scanning. The current study results demonstrated that some bone and gingival dimensions were significantly different between patients with thin and thick gingival biotypes. Some of these dimensions such as the mean bone thickness and GT were

significantly lower in the thin compared to the thick biotype group but the mean distance from the CEJ to bone crest and dentogingival complex dimensions were not significantly different between the two gingival biotypes. The results of the present study clearly showed that the available classifications for tissue biotype as thin/thick are not sufficient for clinical judgment. Individual analysis of each site using soft tissue CBCT may be helpful for a treatment plan based on soft/hard tissue thickness and tooth positioning.

MATERIAL AND METHODS

The present study was undertaken to evaluate and compare CAF with orthodontic button application plus PRF membrane and CAF with orthodontic button alone in treatment of Miller's Class I and Class II gingival recession defects. The evaluation was done clinically and radiographically using CBCT.

Clinical research reported remarkable gain in CAL using CAF in human gingival recession defects. PRF is a natural fibrin-based biomaterial prepared from an anticoagulant-free blood harvest without any artificial biochemical modification that allows obtaining fibrin membranes enriched with platelets and growth factors.

Evidence from the literature suggests the potential role of PRF in periodontal regeneration and tissue engineering but there is paucity of literature available on its use as a regenerative biomaterial in root coverage especially in the treatment of MARTD. So, it was felt necessary to conduct clinical trial and evaluate its efficacy.

Sample size and Selection criteria

20 systemically and periodontally healthy subjects with bilateral Millers Class I and II multiple gingival recession defects were enrolled for this study. Subjects comprises of 16 males and 4 females between the age of 22-47 years. The participants of this study were chosen among individuals who visited to the Periodontology Department of our institute between June 2016 and January 2017.

The study was conducted after the clearance from the local Institutional Ethics committee of our institute. All the subjects were informed about the study and signed an appropriate consent form in agreement with the Helsinki Declaration on human experimentation.

Inclusion Criteria

1) Patients exhibiting bilateral Millers Class I and II multiple gingival recession defects with no interproximal hard and soft tissue destruction.

2) Patients with ≥1mm of attached gingiva with probing pocket depth ≤3 mm at gingival recession sites.

Exclusion Criteria

1) Subjects with history of any known systemic disease, allergies, smoking or drug usage that would alter the healing response of the oral tissues.

2) Subjects who have undergone periodontal therapy in the past 6 months.

3) Recession defects which were associated with caries and teeth with evidence of pulpal pathology.

4) Subjects who were pregnant / lactating.

Randomization

The patients were assigned into two treatment groups i.e. Group I and Group II. The Group I act as control group and Group II as test group. The participants in test group were treated by CAF+B+PRF membrane, while the participants in control group were treated by CAF+B alone. The randomization was achieved by toss of a coin before the surgery of each patient. The outcome of coin toss was written on a paper, which was put in the opaque envelope contained the treatment information for the specific patient by a blind staff; it was opened at the time of surgery, immediately after completing treatment of the root surfaces to prevent surgeon bias.

Clinical procedure

Twenty systemically healthy subjects were included in this clinical trial. Information concerning dietary status, systemic background, and mouth cleaning habits, gingival and periodontal status along with routine clinical data were recorded in the specially designed proforma. Patients were examined under good illumination

with the help of mouth mirror, a tweezer, UNC-15 (University of North Carolina 15) periodontal probe and pellets of cotton.

Pre surgical therapy

In both test and control groups, an initial periodontal therapy consisted of oral hygiene instructions, ultrasonic instrumentation and coronal polishing was done 1 month before surgery. Patients in both the groups were instructed to perform a non-traumatic brushing technique using soft tooth brush. A coronally directed roll technique was prescribed for teeth with recession type defect in order to minimize tooth brushing trauma. The patients were reinstructed about plaque control measures until patients achieved a plaque score of equal or less than one. For evaluation of oral hygiene and gingival health, PI and GI were obtained at baseline, 3 months and 6 months.

Clinical measurements

One month after the completion of initial therapy, on the day of surgical procedure, prior to surgery, clinical data were recorded by the same examiner in all the patients. For evaluation of the oral hygiene and gingival health, full mouth Plaque Index (PI) and Gingival Index (GI) were obtained at baseline, 3 months and 6 months after surgery.

A. PLAQUE INDEX (SILNESS AND LOE 1964)

It was examined in the scoring units of teeth: distofacial, facial, mesiofacial and lingual surfaces. A mouth mirror and dental explorer were used to assess plaque index.

Score	Criteria
0	No plaque.
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen only by running a probe across the tooth surface.
2	Moderate accumulation of soft deposits within the gingival pocket,on the gingival margin and/or adjacent tooth surface, which can be seen by the naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Calculations

A plaque index per person was obtained by adding all of the plaque scores and dividing by the number of surfaces examined.

$$\text{Plaque Index (PI)} = \frac{\text{Total plaque score}}{\text{No. of surfaces examined}}$$

Interpretation

Excellent	0
Good	0.1-0.9
Fair	1.0-1.9
Poor	2.0-3.0

B. GINGIVAL INDEX (LOE AND SILNESS 1963)

The severity of gingivitis was scored on mesial, distal, buccal and palatal/lingual surfaces.

The teeth selected as the index teeth were-

16 - Maxillary Right First Molar

12 - Maxillary Right Lateral Incisor

24 - Maxillary Left First Premolar

36 - Maxillary Left First Molar

32 - Mandibular Left Lateral Incisor

44 - Maxillary Right First Premolar

Score	Criteria
0	Absence of gingival inflammation/normal gingiva.
1	Mild inflammation, slight change in colour, slight oedema, no bleeding on probing.
2	Moderate inflammation, moderate glazing, redness, oedema, hypertrophy, bleeding on probing.
3	Severe inflammation, marked redness and hypertrophy, ulceration, tendency to spontaneous bleeding.

Calculations

The scores of all the surfaces were added and divided by number of surfaces examined which provided the gingival index score per person.

$$\text{Gingival Index (GI)} = \frac{\text{Total GI scores per tooth}}{\text{No. of surfaces}}$$

The numerical scores of the gingival index may be associated with varying degrees of clinical gingivitis as follows:

Gingival scores	Condition
0.1-1.0	Mild gingivitis
1.1-2.0	Moderate gingivitis
2.1-3.0	Severe gingivitis

Clinical measurements

After the hygiene phase of therapy, following clinical measurements were recorded at baseline, 3 & 6 months after surgery, such as GRD, probing depth (PD), CAL and apico-coronal width of keratinized tissue (KTW). These measurements were determined to the nearest millimeter mark by using UNC-15 periodontal probe. Custom made occlusal acrylic stents were used to standardize the probe angulation and position. Occlusal stents were fabricated with cold cured acrylic resin on a cast model obtained from an alginate impression. The occlusal stents covered the occlusal surface of the tooth being treated. Stents also extended apically on the buccal and lingual surfaces so as to cover the coronal third of the teeth. A groove (guide plane) was made in the mid-buccal area on the stent in relation to each involved tooth to guide the periodontal probe while taking measurements. This technique provided fixed angulations for measurements at each site.

1. **Gingival recession depth (GRD)**

   Measured as the distance between the most apical point of the CEJ and the GM.

2. **Probing depth (PD)**

Measured as the distance from the GM to the bottom of the gingival sulcus.

3. **Clinical attachment level (CAL)**

Measured as the distance from the CEJ to the bottom of the sulcus.

4. **Apico-coronal Width of Keratinized Tissue (KTW)**

Measured as the distance from the MGJ to the GM, with the MGJ location determined using a visual method.

Percentage of Root Coverage (%RC) and Complete Root Coverage (CRC)

Percentages of root coverage and complete root coverage were calculated according to the following standard formulae:

$$\text{Percentage of mean root coverage (MRC)} = \frac{(\text{Preoperative GRD} - \text{Postoperative GRD})}{\text{Preoperative GRD}} \times 100$$

$$\text{Percentage of complete root coverage (CRC)} = \frac{\text{Tooth with complete root coverage}}{\text{All treated teeth}} \times 100$$

CBCT analysis

CBCT measurements were taken for each group i.e. the Test and the Control group at baseline and at 6 months. The CBCT analysis included the measurement of GM to crest of alveolar bone (GMB) and also gingival thickness was evaluated at three points i.e. gingival thickness 1 mm above bone crest (GT1), at bone crest (GT2) and 1 mm below bone crest (GT3) for each tooth with GRD.

Surgical armamentarium

All the instruments were autoclaved and arranged in a definite order on sterile drape placed on surgical trolley which was kept within easy reach of the operating and the assisting surgeons.

The surgical armamentarium consists of:

- Mouth mirror.
- UNC-15 probe.
- Straight probe.
- Explorer number 23 and number 17.
- Tweezer.
- Disposable gloves.
- Disposable face masks.
- Disposable syringe – 5ml and 2ml.
- Local anesthetic (2% Xylocaine HCl with adrenaline 1:200000).
- Bard parker handles.
- No. 11 and 15 blades.
- Periosteal elevator (24G Hu-Friedy, USA).
- Gracey curettes.
- Scissors – straight and curved.
- Tissue forceps.
- Needle holder.
- 5-0 resorbable suture with round body needle
- Cotton swabs.

- Kidney tray with saline and irrigation syringe.
- Dappen dish.
- Orthodontic buttons (Lingual button)
- Bracket holder
- Etchant
- Dental Composite material (Adhesive)
- Light cure unit
- Coe – pak.
- Normal saline.
- Denatured spirit.
- 0.2 % Chlorhexidine gluconate

Surgical procedure

After baseline examinations, the patients entered into the surgical phase of the regenerative therapy. Before starting the surgery, orthodontic buttons were applied on all the teeth with GRD with dental composite and then cured with light until hardened.

Local anaesthesia for the respective sites was obtained with 2% Xylocaine HCl with adrenaline (1:200000). After adequate anaesthesia the surgical procedure was initiated. The portion of the roots corresponding to buccal attachment loss was instrumented with Gracey curets.

Control Group

The CAF with orthodontic button was adopted for the control recession defects. The adopted procedure of CAF has been illustrated by **Zucchelli et al.**

(2009)[33] which was a modification for multiple adjacent recessions of the surgical technique described by **De Sanctis and Zucchelli (2007)**[56] for a single-type recession defect.

Two oblique, divergent beveled incisions were performed at the mesial and distal line angles of the two peripherical teeth with gingival recessions. These incisions, together with the intrasulcular incisions along the mesial and distal recession margins, designed the two external surgical papillae. Crossed submarginal incisions, made interproximally, created the interdental surgical papillae. All surgical papillae were dissected, split thickness, up to the probeable sulcular area, keeping the blade almost parallel to the root; the soft tissue apical to the root exposure (including the residual keratinized tissue) was elevated full thickness by inserting a small periosteum elevator into the probable sulcus and proceeding in the apical direction to expose 3 to 4 mm of bone apical to the bone dehiscence. This was done to include the periosteum and the maximum soft tissue thickness in the central portion of the flap covering the avascular root exposure. The vertical releasing incisions were elevated split thickness, keeping the blade almost parallel to the bone plane, thus leaving the periosteum to protect the underlying bone in the lateral areas of the flap. Apical to the bone exposure, split-thickness flap elevation continued until it was possible to move the flap passively in the coronal direction. To permit the coronal advancement of the flap, all muscle insertions present in the thickness of the flap were eliminated. This was done keeping the blade parallel to the external mucosal surface. Coronal mobilization of the flap was considered adequate when the marginal portion of the flap was able to passively reach a level coronal to the CEJ of all teeth with the recession defects. The flap should be stable in its final coronal position, even without

the sutures. Once coronally advanced, the flap partially overlaid the soft tissues mesial and distal to the receiving bed. These areas and the facial soft tissue of the anatomic interdental papillae were de-epithelialized to create connective tissue beds to which the surgical papillae and the peripheral portions of the CAF were sutured.

For suturing 5-0 resorbable suture (nylon monofilament, Ethicon, Johnson & Johnson, Woluwe, Belgium) was used. Suturing of the flap started with two interrupted periosteal sutures at the most apical extension of the vertical releasing incision; it proceeded coronally with other interrupted sutures, each of them directed from the flap to the adjacent buccal soft tissue, in the apical–coronal direction. This was done to facilitate the coronal displacement of the flap and to reduce the tension on the last coronal sling sutures.

Two types of sutures were used for this technique; sling and stabilizing sutures. The sling sutures were used to suspend the central area of the flaps on the buttons. These sling sutures allowed to the most coronal positioning of the flaps. The second stabilizing sutures were performed to accomplish a precise adaptation of the buccal flap on the convexity of the underlying crown surfaces and permitted the stabilization of every surgical papilla over the interdental connective tissue bed. At the end of the surgery, the flap margins were at least 3–4mm coronal to the CEJ of all teeth. Periodontal dressing was applied to avoid any mechanical traumas.

Test Group

For the test group, just prior to surgery after application of the orthodontic buttons, intravenous blood was collected in four 10-ml vials without anticoagulant and immediately centrifuged at 3,000 revolutions per minute for 10 minutes. The

fibrin clot formed in the middle part of the tube. The upper part contained an acellular plasma, and the bottom part contained the red corpuscles. The fibrin clot was easily separated from the lower part of the centrifuged blood and spread on a sterile gauze. Dry gauze was folded over the PRF to make a PRF membrane. This can be easily done by driving out the serum from the clot.

The surgical technique applied in the test recession defects was same as that applied for the control group. After reflection of the flap in the previously described manner and elimination of the muscle insertion, the previously prepared PRF membrane was positioned over the recession defects, just below the CEJ. The gingival flap was repositioned and secured by sling and stabilizing sutures with its margin located on the enamel.

Post-surgical care

The patients were prescribed analgesic (Ibuprofen) and antibiotic (Amoxicillin 500 mg) for 5 days. All the patients were instructed to abstain from brushing and flossing around the surgical area until suture removal and to consume only soft and warm food during the first week. The patients were instructed to rinse with chlorhexidine solution (0.12%) two times a day for 1 min. The sutures, buttons and periodontal dressing were removed 14 days after surgery. Plaque control in the surgically treated area was maintained by chlorhexidine rinsing for an additional 2 weeks. After this period, patients were reinstructed in mechanical cleaning of the treated tooth and used a post-surgical soft tooth brush and a roll technique for 1 month. A chlorhexidine rinse was used twice a day during this period. Thereafter, the patients used a soft toothbrush and chlorhexidine once a day. All patients were

recalled for prophylaxis 2 and 4 weeks after suture removal and at 3 and 6 months postoperatively.

Post-surgical evaluation

A. Patient evaluation of post-operative discomfort and aesthetics

Questions were asked to each patient and the evaluation of the intensity of the given event was marked on a 100 mm visual analog scale (VAS). The questions were divided into two parts: the first part, regarding the post-operative morbidity, was completed 1 week after the surgery, and the second part, concerning patient satisfaction with the aesthetic outcome, was completed at the 6 months follow-up visit. The post-operative course was evaluated 1 week after surgery based on a VAS (VAS-P). Patients were asked to select among 100 scores (zero indicating very bad, 50 indicating average and 100 indicating an excellent post-operative course). Patient satisfaction with aesthetics was evaluated at the 6-months follow-up visit based on a VAS (VAS-E). Patients were asked to select among 100 scores (zero indicating very bad, 50 indicating average and 100 indicating excellent) in terms of overall satisfaction, colour match and the amount of root coverage.[33]

B. Evaluation of aesthetic outcomes

The aesthetic evaluation was performed according to the root coverage aesthetic score system (RES), which was proposed by Cairo et al. (2009)[57] . The RES system evaluated five variables 6 months following surgery which include GM, marginal tissue contour (MTC), soft tissue texture (STT), MGJ alignment, and gingival color (GC). Zero, 3, or 6 points were used for the

evaluation of the position of the GM, whereas a score of 0 or 1 point was used for each of the other variables. For GM, Zero points stand for failure of root coverage (GM apical or equal to the baseline recession); 3 points stand for partial root coverage; 6 points stand for CRC. For MTC, Zero points stand for irregular GM (does not follow the CEJ); 1 point stands for proper marginal contour/ scalloped GM (follows the CEJ). For STT, Zero points stand for scar formation and/or keloid like appearance; 1 point stands for absence of scar or keloid formation. For MGJ, Zero points stand for MGJ not aligned with the MGJ of adjacent teeth; 1 point stands for MGJ aligned with the MGJ of adjacent teeth. For GC, Zero points stand for color of tissue varies from gingival color at adjacent teeth; 1 point stands for normal color and integration with the adjacent soft tissues. Thus, the ideal esthetic score was 10. Zero points were assigned if the final position of the GM was equal or apical to the previous RD (failure of root coverage procedure), irrespective of color, the presence of a scar, MTC or MGJ. Zero points were also assigned when a partial or total loss of interproximal papilla (black triangle) occurred following the treatment.

CBCT measurements

All the sites in both the groups were subjected to CBCT assessment.

The KODAK 9000C Imaging System using the KODAK Imaging for the CBCT assessment. Patient was asked to remove all metal objects and wear a lead apron. The patients were asked to wore a plastic lip retractor and retract their tongues toward the floor of their mouths. Then they were asked to bite gently and naturally on

the bite block without joining the incisors. The upper incisors centered with the bite patient was adjusted using two positional laser beams

- The mid-sagittal
- The 3D FoV positioning laser beam

The digital readout was seen on the computer screen.

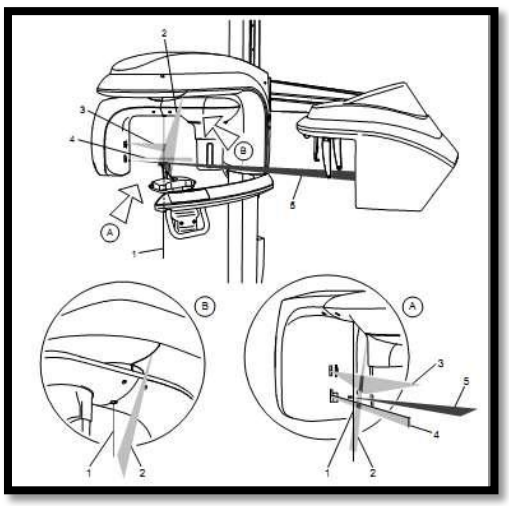


Figure 1. KODAK 9000C AND KODAK 9000C 3D Unit Laser Positions

1. 3D Central positioning laser beam
2. Mid-sagittal positioning laser beam
3. Horizontal positioning laser beam
4. 3D Field of View (FoV) positioning laser beam
5. Cephalometric Frankfort positioning laser beam

All the CBCT images were analysed in parasagittal section.

The parameters which were measured on CBCT included -

- Distance of facial alveolar bone crest to gingival margin (GMB). This measurement was performed on facial aspect of the tooth parallel to the long axis of tooth.

Facial gingival thickness were measured on facial aspect at three different points -

- GT1 was measured 1 mm apical to alveolar bone crest, GT2 at alveolar bone crest and GT3 at 1 mm coronal to alveolar bone crest. These measurements were performed perpendicular to the long axis of tooth.

COLOR PLATE I

INSTRUMENTATION

Surgical Armamentarium

MATERIALS USED

Orthodontic Button

Dental Composite, Etchant, Bonding Agent

PRF

PRF Membrane

COLOR PLATE II

SURGICAL PROTOCOL FOR CORONALLY ADVANCED FLAP ALONG WITH ORTHODONTIC BUTTON APPLICATION

(GROUP I)

Preoperative Photograph

Preoperative Photograph

Intraoperative Photograph

Intraoperative Photograph

Sutured Flap

Application of Periodontal Pack

COLOR PLATE III

SURGICAL PROTOCOL FOR CORONALLY ADVANCED FLAP WITH ORTHODONTIC BUTTON APPLICATION WITH PRF MEMBRANE

(GROUP II)

Preoperative Photograph

Preoperative Photograph

Intraoperative Photograph

Intraoperative Photograph

Sutured Flap

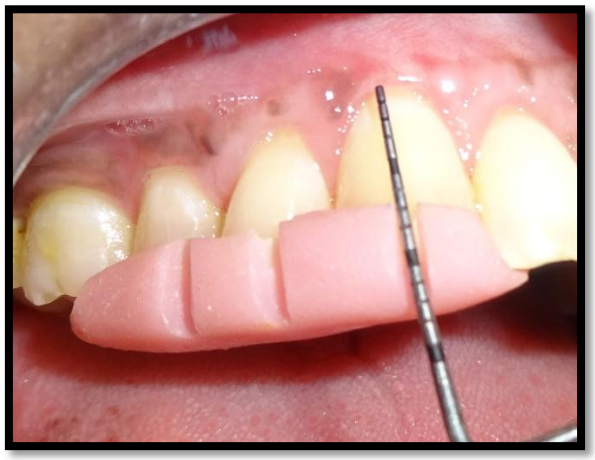
Application of Periodontal Pack

COLOR PLATE IV

RECALL-

CORONALLY ADVANCED FLAP WITH ORTHODONTIC BUTTON

BASELINE



3 MONTH RECALL

6 MONTH RECALL

COLOR PLATE V

RECALL-

CORONALLY ADVANCED FLAP WITH ORTHODONTIC BUTTON WITH PRF MEMBRANE

BASELINE

3 MONTH RECALL

6 MONTH RECALL

COLOR PLATE VI

CBCT PARAMETERS

CORONALLY ADVANCED FLAP ALONG WITH ORTHODONTIC BUTTON APPLICATION

(GROUP I)

BASELINE **6 MONTH RECALL**

CORONALLY ADVANCED FLAP ALONG WITH ORTHODONTIC BUTTON APPLICATION WITH PRF MEMBRANE

(GROUP II)

BASELINE **6 MONTH RECALL**

RESULTS

The present study was conducted in Department of Periodontology with an aim to evaluate and compare the effectiveness of CAF with orthodontic button application with and without PRF membrane in treatment of multiple gingival recession defects, clinically and radiographically by CBCT.

Clinical parameters such as PI, GI, GRD, PD, CAL and KTW were the assessed at baseline, 3 month and 6 month. Whereas radiographical parameters such as distance between gingival margin and alveolar bone (GMB) and gingival thickness (GT1, GT2 and GT3) were assessed at baseline and 6 month by CBCT.

Aesthetic evaluation was done according to root coverage aesthetic score system (RES) considering level of gingival margin (GM), marginal tissue contour (MTC), soft tissue texture (STT), muco-gingival junction (MGJ) alignment and gingival colour (GC). Also postoperative discomfort and aesthetics outcome was assessed by visual analog scale (VAS).

Statistical Analysis

The data was analyzed using STATA version 14.0 (StataCorp LP, Texas, USA). The p value was taken as significant when less than 0.05. The tests applied were -

Descriptive statistics were presented as Mean ± Standard deviation for all study parameters. Clinical parameters were compared at different time period postoperatively within group by performing one way repeated measure of analysis ANOVA.

Paired t-test was used to compare clinical parameters between baseline to 6 month postoperatively in each group.

Changes in clinical parameters at 3 month and 6 month from baseline between group were compared by performing Mann-whitney test for non-normalized data.

Independent t-test was applied for normalized data.

Complete root coverage was compared between the groups by performing Chi square test.

Total 20 patients, 16 males and 4 females in the age range of 22-47 years were included in this study. All patients were non-smokers and were systemically and periodontally healthy. The defects were randomly divided into two groups, Group I and Group II. Group I (control group) included 75 multiple gingival recession defects and were treated by Coronally advanced flap with orthodontic button application (CAF+B) and Group II (test group) included 75 multiple gingival recession defects and were treated by Coronally advanced flap with PRF membrane along with orthodontic button application (CAF+B+PRF membrane).

During the course of study, wound healing was uneventful in both the groups, without any signs of infections or complications. There was no untoward local and systemic reaction.

In general, patients showed good oral hygiene through the complete duration of the study. Baseline full mouth plaque score was 0.92 ± 0.11, while at 3 month and 6 months it was 0.94 ± 0.11, 0.94 ± 0.13 respectively. The difference between PI scores at baseline versus 3 month and 6 month showed statistically non-significant difference. Similarly PI score when compared at 3 month and 6 month showed statistically non-significant difference (p=0.902). **(Table 1)**

The mean GI at baseline was 0.68 ± 0.26 and at 3 month and 6 month was 0.72 ± 0.25, 0.70 ± 0.24 respectively. GI scores when compared with baseline to 3 month and 6 month showed statistically non-significant difference and also when GI score at 3 month and 6 month was compared, the difference was statistically non-significant (p=0.816). **(Table 2)**

BASELINE DEFECT CHARACTERISTICS

The baseline mean GRD in Group I was 2.93 ± 0.77 mm and in Group II was 2.98 ± 0.76 mm. The mean PD at baseline in Group I was 1.70 ± 0.26 mm and in Group II was 1.69 ± 0.46 mm. The baseline mean CAL in Group I was 4.64 ± 0.72 mm and in Group II was 4.66 ± 0.77 mm. The baseline mean KTW in Group I was 2.56 ± 0.49 mm and in Group II was 2.48 ± 0.52 mm. At baseline, no statistically significant differences in any of the above mentioned clinical parameters were observed between Group I and Group II, indicating that the patient and defect selection was appropriate, comparable and devoid of any bias.

CLINICAL OUTCOMES AT 3 AND 6 MONTH

Gingival Recession Depth (GRD)

In Group I, the mean GRD was 2.93 ± 0.77 mm, 0.73 ± 0.72 mm and 0.21 ± 0.41 mm at baseline, 3 month and 6 month respectively. At 3 month the mean GRD reduction was 2.20 ± 0.69 mm and at 6 month the mean GRD reduction was 2.72 ± 0.72 mm compared to baseline. There was a statistically significant reduction in GRD at 3 month and 6 month compared to baseline ($p<0.001$). The mean GRD reduction was 0.52 ± 0.57 mm at 6 month compared to 3 month. This reduction was statistically highly significant ($p<0.001$). **(Table 3, 4)**

In Group II, the mean GRD was 2.98 ± 0.76 mm, 0.62 ± 0.71mm and 0.17 ± 0.38 mm at baseline, 3 month and 6 month respectively. At 3 month the mean GRD reduction was 2.36 ± 0.62 mm and at 6 month the mean GRD reduction was 2.81 ± 0.63 mm compared to baseline. There was a statistically significant reduction in GRD

at 3 month and 6 month compared to baseline ($p<0.001$). The mean GRD reduction was 0.45 ± 0.52 mm at 6 month compared to 3 month. This reduction was statistically highly significant ($p<0.001$). **(Table 3, 4)**

At 3 month the mean GRD reduction was 2.20 ± 0.69 mm in Group I and 2.36± 0.62 mm in Group II compared to baseline. This mean GRD reduction between Group I and Group II at 3 month was statistically non-significant ($t=1.4753$, $p=0.1423$). At 6 months the mean GRD reduction was 2.72 ±0.72 mm in Group I and 2.81 ± 0.63 mm in Group II compared to baseline. This mean GRD reduction between Group I and Group II at 6 month was statistically non-significant ($t=0.8401$, $p=0.4022$). The mean reduction in GRD from 3 month to 6 month was 0.52 ± 0.57 mm in Group I and 0.45 ±0.52 mm in Group II. This mean GRD reduction at from 3 month to 6 month was statistically non-significant ($p=0.5350$). **(Table 5)**

Percentage Root Coverage (% RC)

The percentage of reduction in overall gingival recession was calculated at end of 3 month and 6 month. In Group I, the percentage root coverage was 79.49 ± 21.83 % at 3 month and 93.17 ± 13.23 % at 6 month. This difference was statistically highly significant ($p<0.0001$). In Group II, the percentage root coverage was 80.15 ± 19.65 % at 3 month and 95.68 ± 10.13% at 6 month. This difference was statistically highly significant ($p<0.0001$). **(Table 6)**

The difference in percentage root coverage between Group I and Group II was statistically non-significant at 3 month ($p=0.8170$) and 6 month ($p=0.2925$). **(Table 7)**

Percentage of Complete Root Coverage (CRC)

In Group I complete root coverage was achieved in 32 out of 75 (42.66%) treated gingival recession defects at 3 month and 59 out of 75 (78.66%) at 6 month. This increase in the percentage of complete root coverage in Group I was statistically highly significant ($p<0.0001$). **(Table 8)**

In Group II complete root coverage was achieved in 38 out of 75 (50.66%) treated gingival recession defects at 3 month and 62 out of 75 (82.66%) at 6 month. This increase in the percentage of complete root coverage in Group II was statistically highly significant ($p<0.0001$). **(Table 8)**

Although Group II exhibited more sites with complete root coverage than Group I, the difference was statistically not significant at 3 month ($p=0.326$) and 6 month ($p=0.535$). **(Table 9)**

Probing Depth (PD)

In Group I, the mean PPD was 1.70 ± 0.26 mm, 1.45 ± 0.50 mm and 1.34 ± 0.47 mm at baseline, 3 month and 6 month respectively. The reduction in mean PD was 0.25 ± 0.52 mm at 3 month and 0.36 ± 0.53 mm at 6 month compared to baseline. This reduction in mean PD at 3 month and 6 month was statistically highly significant ($p<0.001$). The mean PD significantly reduced by 0.10 ± 0.31mm at 6 month compared to 3 month. ($p=0.004$). **(Table 10, 11)**

In Group II, the mean PD was 1.69 ± 0.46 mm, 1.42 ± 0.49 mm and 1.37 ± 0.48 mm at baseline, 3 month and 6 month respectively. The reduction in mean PD was 0.26 ± 0.66 mm at 3 month and 0.32 ± 0.70 mm at 6 month compared to baseline.

This reduction in mean PD at 3 month and 6 month was statistically highly significant ($p<0.001$). The mean PD reduced by 0.053 ± 0.46 mm at 6 month compared to 3 month and this reduction was statistically non-significant ($p=0.321$). **(Table 10, 11)**

At 3 month the mean PD reduction was 0.25 ± 0.52 mm in Group I and 0.26 ± 0.66 mm in Group II compared to baseline. This mean PD reduction between Group I and Group II at 3 month was statistically non-significant ($p=0.6894$). At 6 months the mean PD reduction was 0.36 ±0.53 mm in Group I and 0.32 ±0.70 mm in Group II compared to baseline. This mean PD reduction between Group I and Group II at 6 month was statistically non-significant ($t=0.006$, $p=0.9950$). The mean reduction in PD from 3 month to 6 month was 0.10 ±0.31 mm in Group I and 0.53 ±0.46 mm in Group II. This mean PD reduction from 3 month to 6 month was statistically non-significant ($p=0.4571$).). **(Table 12)**

Clinical attachment level (CAL)

In Group I, the mean CAL was 4.64 ± 0.72 mm, 2.18 ± 0.83 mm and 1.56 ± 0.62 mm at baseline, 3 month and 6 month respectively **(Table 6)**. The gain in mean CAL was 2.45 ± 0.79 mm at 3 month and 3.08 ± 0.80 mm at 6 month compared to baseline. This gain in mean CAL at 3 month and 6 month was statistically highly significant ($p<0.001$). The mean CAL gain was 0.62 ± 0.65 mm at 6 month compared to 3 month. This increase was statistically highly significant ($p<0.001$). **(Table 13, 14)**

In Group II, the mean CAL was 4.66 ± 0.77 mm, 2.08 ± 0.74 mm and 1.53 ± 0.52 mm at baseline, 3 month and 6 month respectively. The gain in mean CAL was 2.58 ± 0.63 mm at 3 month and 3.13 ± 0.76 mm at 6 month compared to baseline. This gain in mean CAL at 3 month and 6 month was statistically highly significant

($p<0.001$). The mean CAL gain was 0.54 ± 0.64 mm at 6 month compared to 3 month. This increase was statistically highly significant ($p<0.001$). **(Table 13, 14)**

At 3 month the mean CAL gain was 2.45 ± 0.79 mm in Group I and 2.58 ± 0.63 mm in Group II compared to baseline. This mean CAL gain between Group I and Group II at 3 month was statistically non-significant ($t=1.802$, $p=0.0716$). At 6 months the mean CAL gain was 3.08 ± 0.80 mm in Group I and 3.13 ± 0.76 mm in Group II compared to baseline. This mean CAL gain between Group I and Group II at 6 month was statistically non-significant ($t=0.485$, $p=0.6275$). The mean CAL gain from 3 month to 6 month was 0.62 ± 0.65 mm in Group I and 0.54 ±0.64 mm in Group II. This gain in mean CAL from 3 month to 6 month was statistically non-significant ($p=0.6805$). **(Table 15)**

Keratinized Tissue Width (KTW)

In Group I, the mean KTW was 2.56 ± 0.49 mm, 3.21 ± 0.50 mm and 3.44 ± 0.64 mm at baseline, 3 month and 6 month respectively **(Table 6)**. The gain in mean KTW was 0.65 ± 0.55 mm at 3 month and 0.88 ± 0.75 mm at 6 month compared to baseline. This increase in mean KTW at 3 month and 6 month was statistically highly significant ($p<0.001$). Whereas a non-significant increase in KTW by 0.22 ± 0.42 mm was observed at 6 month compared to 3 month ($p=0.214$). **(Table 16, 17)**

In Group II, the mean KTW was 2.48 ± 0.52 mm, 3.34 ± 0.60 mm and 3.62 ± 0.61 mm at baseline, 3 month and 6 month respectively **(Table 6)**. The gain in mean KTW was 0.86 ± 0.60 mm at 3 month and 1.14 ± 0.67 mm at 6 month compared to baseline. This increase in mean KTW at 3 month and 6 month was statistically highly significant ($p<0.001$). The mean KTW increased by 0.28 ± 0.48 mm at 6 month

compared to 3 month. This increase was statistically highly significant (p<0.001). **(Table 16, 17)**

At 3 month the increase in mean KTW was 0.65 ± 0.55 mm in Group I and 0.86 ± 0.60 mm in Group II compared to baseline. This increase in mean KTW between Group I and Group II at 3 month was statistically significant (p=0.0412). At 3 month the increase in mean KTW was 0.88 ± 0.75 mm in Group I and 1.14 ± 0.67 mm in Group II compared to baseline. This increase in mean KTW between Group I and Group II at 6 month was statistically significant (p=0.0309). The mean KTW gain from 3 month to 6 month was 0.22 ± 0.42 mm in Group I and 0.28 ±0.48 mm in Group II. This increase in mean KTW from 3 month to 6 month was statistically non-significant (p=0.4372). **(Table 18)**

CBCT ANALYSIS OF GINGIVAL RECESSION

Distance between Gingival Margin and Bone Crest (GMB)

In Group I, the mean GMB was 2.36 ± 0.55 mm at baseline and 3.58 ± 0.51 mm at 6 month. This increase in mean GMB at 6 month compared to baseline was statistically highly significant (p<0.0001). **(Table 19)**

In Group II, mean GMB was 2.47 ± 0.56 mm at baseline and 3.77 ± 0.46 mm at 6 month. This increase in mean GMB at 6 month compared to baseline was statistically highly significant (p<0.0001). **(Table 19)**

At 6 month, the mean GMB increased by 1.22 ± 0.53 mm in Group I and 1.30 ± 0.41 mm in Group II compared to baseline. Although increase in mean GMB was greater in Group II than Group I, it did not reach the level of statistical significance (p=0.2554). **(Table 20)**

Gingival Thickness

GT1

In Group I, the mean GT1 was 1.15 ± 0.56 mm at baseline and 1.85 ± 0.53 at 6 month. The mean GT1 increased by 0.69 ± 0.42 mm at 6 month compared to baseline. This increase within the group was statistically highly significant ($p<0.0001$). **(Table 21)**

In Group II, the mean GT1 was 1.06 ± 0.31 mm at baseline and 2.30 ± 0.61 mm at 6 month. The mean GT1 increased by 1.24 ± 0.63 mm at 6 month compared to baseline. This increase within the group was statistically highly significant ($p<0.0001$). **(Table 21)**

The mean change in the GT1 was 0.69 ± 0.42 mm in Group I and 1.24 ± 0.63 mm in Group II at 6 month compared to baseline. This difference was statistically highly significant ($p<0.0001$). **(Table 22)**

GT2

In Group I, the mean GT2 was 1.47 ± 0.45 mm at baseline and 2.02 ± 0.36 at 6 month. The mean GT2 increased by 0.55 ± 0.26 mm at 6 month compared to baseline. This increase within the group was statistically highly significant ($p<0.0001$). **(Table 23)**

In Group II, the mean GT2 was 1.29 ± 0.35 mm at baseline and 2.44 ± 0.61 mm at 6 month. The mean GT1 increased by 1.14 ± 0.56 mm at 6 month compared to baseline. This increase within the group was statistically highly significant ($p<0.0001$). **(Table 23)**

The mean change in the GT2 was 0.55 ± 0.26 mm in Group I and 1.14 ± 0.56 mm in Group II at 6 month compared to baseline. This difference was statistically highly significant (p<0.0001). **(Table 24)**

GT3

In Group I, the mean GT3 was 1.11 ± 0.36 mm at baseline and 1.73 ± 0.39 mm at 6 month. The mean GT3 increased by 0.61 ± 0.32 mm at 6 month compared to baseline. This increase within the group was statistically highly significant (p<0.0001). **(Table 25)**

In Group II, the mean GT3 was 1.10 ± 0.35 mm at baseline and 2.23 ± 0.65 mm at 6 month. The mean GT3 increased by 1.13 ± 0.67 mm at 6 month compared to baseline. This increase within the group was statistically highly significant (p<0.0001). **(Table 25)**

The mean change in the GT3 was 0.61 ± 0.32 mm in Group I and 1.13 ± 0.67 mm in Group II at 6 month compared to baseline. This difference was statistically highly significant (p<0.0001). **(Table 26)**

POST-OPERATIVE DISCOMFORT AND AESTHETIC OUTCOMES

The aesthetic outcomes of the both techniques were evaluated by Root Coverage Aesthetic Score system (RES). The scores for both groups were high. The RES score for Group I was 8.69 ± 1.46 and for Group II was 8.84 ± 1.41. This difference was statistically non-significant (p= 0.5332) showing equal aesthetic outcomes in both the groups. **(Table 27)**

Post-operative discomfort was evaluated 1 week after the surgery on 100 mm visual analog scale (VAS-P). The VAS-P scores for Group I was 70.0 ± 29.91 mm and that for Group II was 65.0 ± 28.56 mm. This difference between the two groups was statistically non-significant (p= 0.5581). **(Table 27)**

Patients satisfaction with aesthetic was evaluated at 6 months follow up visit on VAS (VAS-E). VAS-E score for Group I was 72.5 ± 25.52 and for Group II was 75.0 ± 25.64, this difference was statistically non-significant indicating equal patient satisfaction of treatment outcome in both the groups. **(Table 27)**

DISCUSSION

The treatment of multiple adjacent recession type defects (MARTD) differs from the treatment of single type of recession defects. Studies have suggested that the choice of treatment for MARTD may be based on variety of factors involving anatomic structures such as size of the defect, width of keratinized tissue, amount of connective tissue available from the donor site, mucogingival phenotypes and number of adjacent teeth to be treated. Also, level of discomfort during healing and cost plays an important role. Techniques such as CAF with and without vertical releasing incisions[33], modified CAF technique[20], modified CAF combined with an subepithelial

connective tissue graft[35], CAF with CTG[33], or the tunnel SCTG[22], or CAF with enamel matrix derivative[24] have been proposed to treat such defects.

Connective tissue technique is considered as one of the most predictable and reproducible technique to achieve root coverage. Inherent problem with CTG as a grafting material in MARTD is a limited quantity of available graft, post-operative discomfort and complication. This is especially important when patient do not comply with a necessary second surgical site required to procure CTG.

Limited amount of regeneration was observed with conventional technique when quality of healing examined histologically.[58,59] Therefore various adjunctive agents were tried to accelerate healing and enhance clinical outcome. These adjunctives included root conditioners[60], enamel matrix protein[23\], recombinant human platelet derived growth factor[61], etc. The cost of mucogingival operations may arise when such adjunctives are used. So when multiple recession defects are present in the aesthetic area of the mouth, patient related considerations hold an utmost importance in selection of surgical technique. Patient compliance, aesthetic appearance, simplicity and cost play a substantial role in the selection of treatment technique.

The coronal advancement of the flap may be recommended in patients with adequate amount of keratinized tissue apical to recession defect. **Roccuzzo et al. (2002)**[40] proclaimed that optimum root coverage along with good colour blending of the treated area with respect to adjacent soft tissues and complete recovery of the pre-surgical soft tissue marginal morphology can be predictably accomplished by means of this surgical approach. Furthermore, the post-operative course is also less troublesome for the patient as second surgical sites is not involved. **Zucchelli et al.**

(2009)[33] suggested a modified CAF (MCAF) technique for the resolution of MARTD and authors reported better results for MCAF as compared with CAF alone.

According to observations of the study done by **Pini Prato et al. (2005)**[62], the location GM at the end of the surgery appeared to have an influence on attaining CRC. It is hard to protect most possible coronal position of the gingival margin during healing period. **Ozcelik et al. (2011)**[30] used orthodontic button for the stabilization of the immediate postoperative flap location and reported promising results.

PRF introduced by **Choukroun et al. (2001)**[63] is considered as a second generation platelet concentrate. PRF has shown a proliferative effect on different types of cells such as dental pulp cells, human osteoblasts, human gingival and periodontal ligament fibroblasts, dermal prekeratinocytes and preadipocytes.[27] The homogeneous 3 dimensional naturally polymerized fibrin network is considered as a healing biomaterial and is used to enhance periodontal regeneration.[27] In contrast to the previous biomaterial, platelet-rich plasma (PRP) and other platelet concentrate use for treatment of recession **(Huang LH et al. 2005)** [25], preparation of PRF is simpler and faster because it does not require additional anticoagulants. In addition, when compared with PRP, PRF exhibits a greater expression and concentration of growth factors and matrix proteins released more slowly because of the three dimensional architecture of the adhesive glycoproteins in the fibrin. Autologous PRF is a readily available and inexpensive biomaterial.[27]

The present randomized controlled study was performed to evaluate and compare the clinical efficacy of CAF along with orthodontic button application and CAF with PRF membrane along with orthodontic button application in the treatment of multiple

adjacent gingival recession defect. A total of 20 patients with mean age of 32.65 years (16 male and 4 female) with age range 22-47 years were selected for study. All patients had Miller's Class I and Class II gingival recession defect on at-least two adjacent teeth. Clinical parameters such as GRD, PD, CAL and KTW were recorded at baseline, 3 and 6 month postoperatively. Radiographic parameters such as distance between gingival margin and alveolar bone crest (GMB) and gingival thickness (GT1, GT2 and GT3) were recorded at baseline and 6 month postoperatively on CBCT.

Systemically healthy patients were selected for this study to avoid the altered host response caused by various systemic illnesses which could have acted as confounding factors or effect modifiers affecting the response to surgical therapy.

The smokers and tobacco chewers were excluded from the study. It has been shown that number of cigarettes smoked daily is an important issue. Smoking ≥10 cigarettes per day is strongly associated with periodontal disease.[64] Thus cigarette smoking may affect the short term outcome of root coverage procedures.[64]

At baseline, no significant differences in any of the investigated parameters were observed between Group I and Group II indicating that the patient and defect selection was appropriate and devoid of any bias. During the course of study, wound healing was uneventful in Group I and Group II without any signs of infection and complications. There was no untoward local and systemic reaction indicating the biocompatibility of autologous PRF.

The patients included in present study showed reasonably good oral hygiene level and healthy clinical condition of gingiva throughout the study. The plaque index score

was 0.92 ± 0.11, 0.94 ± 0.11, 0.94 ± 0.13 at baseline, 3 month and 6 months respectively. The plaque index remained below 1 throughout the study period. The gingival index at baseline was 0.68 ± 0.26 and it remained low i.e.0.72 ± 0.25 and 0.70 ± 0.24 during 3 and 6 month period (<1). This was the result of repeated oral hygiene instructions given to the patients throughout the study period. Plaque control is essential for the long term stability of clinical outcomes. Bacterial plaque is a major and important factor in the etiology of periodontal destruction and successful therapy depends upon its removal subsequent to treatment.[4] Maintenance of good oral hygiene directly affects the longitudinal stability of soft tissue position.[7]

In Group I, the mean gingival recession depth (GRD) at baseline, 3 month and 6 month was 2.93 ± 0.77 mm, 0.73 ± 0.72 mm. and 0.21 ± 0.41 mm respectively. In Group II, the mean GRD at baseline, 3 month and 6 month was 2.98 ± 0.76 mm, 0.62 ± 0.71 mm and 0.17 ± 0.38 mm respectively.

At 3 months mean GRD reduction for group I was 2.20 ± 0.69 mm and for group II was 2.36 ± 0.62 mm and this difference between the groups was statistically non-significant. At 6 months mean GRD reduction for group I was 2.72 ±0.72 mm and for group II was 2.81 ±0.63 mm. This difference between the groups at 6 months was also statistically non-significant. During all the time intervals i.e. at 3 and 6 month, there was statistically highly significant reduction in GRD in both groups when compared to baseline.

The result of our study are similar to observations of **Khobragade et al. (2016)**[49] where authors compared the effectiveness of modified CAF with orthodontic button application (CAF+B) and modified CAF for the correction of multiple recession

defects. Authors found that the mean GRD reduced from 3.10 ± 0.76 mm to 0.25 ± 0.51 mm in CAF+B group and 3.14 ± 0.69 mm to 0.75 ± 0.76 mm in modified CAF group at 6 month which was statistically significant when compared to baseline and statistically significant reduction was observed in CAF+B group compared to CAF alone group. This significant reduction in the GRD in CAF+B can be attributed to the split-full-split thickness flap design and the suspended sutures placed on orthodontic button used for root coverage. The same split-full-split thickness flap design and suturing technique was adopted in our study. This flap design provides better opportunity for root coverage by elevating a full thickness flap apical to the gingival recession defect thus preserving the maximum keratinized tissue which covers the exposed root surface and it also reduces the chances of flap perforation. Additionally, a sharp split thickness dissection and vertical releasing incision could have permitted more flap mobilization.

The findings our study also correlate to the findings of **Ozcelik et al. (2011)**[30] where authors compared CAF combined with orthodontic button application and CAF alone for the treatment of multiple recession type defects. At 6 months authors noted a mean reduction of 4.65 ± 0.99 mm for CAF combined with orthodontic button group and 3.89 ± 0.98 mm for CAF group showing statistically significant GRD reduction in the group where orthodontic buttons were applied. In our study on both side i.e. in Group I and Group II orthodontic button was used for holding flap in coronal position. Suspended sutures used with the application of orthodontic button not only help in maximum coronal positioning of the flap, it also provides an anchorage for the coronally displaced flap stabilizing the flap in the coronally displaced position during initial crucial days of wound healing. At 6 month in Group II where PRF membrane

was used reduction in GRD was more, possibly showing beneficial effects of PRF but difference in the treatment groups fails to reach the level of statistical significance.

The efficacy of PRF membrane in root coverage procedure was compared with CTG by **Jankovic et al. (2012)**[46] and **Uraz et al. (2013)**[47]. **Jankovic et al. (2012)**[46] evaluated and compared the use of CAF+PRF membrane and CAF+CTG for the treatment of isolated or multiple gingival recession defects. Recession depth in the PRF group decreased from 3.51 ± 0.70 to 0.68 ± 0.45 mm and in the CTG group it decreased from 3.45 ± 0.84 mm to 0.38 ± 0.48 mm at 6 month. Intergroup comparison at 6 month showed non-significant differences showing comparable treatment outcome of use PRF with CTG which is considered to be gold standard. Similarly, **Uraz et al. (2013)**[47] studied and compared the effectiveness and predictability of the PRF membrane with expanded mesh CTG (e-CTG) for treatment of MARTD. In the PRF membrane group the mean GRD reduced from 4.73 ± 1.30 to 1.17 ± 1.47 mm at 6 month which was statistically significant compared to baseline. At 6 months, the amount of recession reduction obtained with PRF membrane group was similar to that obtained with CAF+e-MCTG group. **Tunali et al. (2015)**[65] evaluated the safety and effectiveness of using L-PRF membranes as a substitute for free connective tissue grafts as a treatment method for multiple gingival recession defects. They observed a significant reduction in initial recession depth from 4.45 ± 0.18 mm to 1.14 ± 0.06 mm in L-PRF group and from 4.02 ± 0.12 mm to 1.14 ± 0.04 mm in CTG group 6 month after surgery.

In our study variation in terms of more amount of recession depth reduction in both groups can be attributed to the use of suspended sutures with orthodontic button,

comparatively a lesser amount of initial gingival recession depth, all recession defects in maxillary anterior region and use of modified coronally advanced flap with vertical releasing incision.

Thamaraiselvan et al. (2015)[66] and **Padma et al. (2013)**[67] obtained a significant reduction in the gingival recession depth at 6 month in CAF+PRF membrane group compared to CAF alone group in the treatment of isolated gingival recession defects whereas we found a statistically non-significant difference in GRD reduction for Group I and Group II at 6 month. Possible reason for variation can be the selection of the isolated recession defects by the authors which differs from our inclusion criteria of MARTD. The treatment outcome of MARTD shows some differences when compared with single type of recession.

In this study the percentage of root coverage was calculated 3 and 6 month post operatively. In group I the percentage of root coverage was 79.49 ± 21.83 % that in group II was 80.15 ± 19.65 % at the end of 3 month. Whereas at the end of 6 months the percentage of root coverage in Group I was 93.17 ± 13.23 % and in Group II it was 95.68 ± 10.13%. This difference was found to be statistically non-significant when intergroup comparisons were done.

In our study, 32 out of 75 (42.66 %) treated sites showed complete root coverage in Group I and 38 out of 75 (50.66%) of treated sites showed complete root coverage in Group II at 3 month. 6 month post-operatively in Group I complete root coverage was achieved in 59 out of 75 (78.66%) treated gingival recession defects and 62 out of 75 (82.66%) treated gingival recession defects in Group II. Although Group II exhibited

more sites with complete root coverage than Group I this difference was statistically not significant at 6 month.

These results are in accordance to the study done by **Ozcelik et al. (2011)**[30] where authors achieved mean root coverage of 96.2 ± 9.4 % in CAF+B group and 89.1 ± 14.3 % in CAF alone group at 6 month. This difference was statistically higher in CAF+B group. Complete root coverage was seen in 66 out of 78 (84.6%) treated sites in CAF+B group and 47 out of 77 (61%) treated sites in CAF alone group at 6 month. Similarly **Khobragade et al. (2016)**[49] found highly significant difference in percentage mean root coverage and complete root coverage in CAF+B group and CAF alone group favouring CAF+B group. They achieved mean root coverage of 92.23 ± 15.61 % for CAF+B group and 78.30 ± 20.75% for CAF alone group. Complete root coverage was seen in 46 out of 57 (77.9%) treated sites in CAF+B group and 25 out of 57 (43.8%) treated sites in CAF alone group at 6 month. The variation in the amount of root coverage in our study and other studies can be attributed to variation in the gingival recession defects in these studies at baseline. **Thamaraiselvan et al. (2015)**[66] achieved mean root coverage of 74.16 ± 28.98% in CAF+ PRF membrane group and 65.00 ± 44.47% in CAF alone group at 6 months. Although more percentage of mean root coverage was observed in CAF+PRF membrane group, it was not statistically significant when intergroup comparison was done. They also observed 50% complete root coverage in both the groups at 6 month.

Tunali et al. (2015)[65] and **Eren et al. (2014)**[68] observed a comparable percentage of root coverage at 6 month when CAF+PRF group was compared with CAF+CTG group. **Tunali et al. (2015)**[65] achieved mean root coverage of 74.61 % for L-PRF

group and 74.13% for CTG group at 6 month. This difference in the amount of root coverage between both the groups was not significant. **Eren et al. (2014)**[68] found no statistically differences in percentage of root coverage and complete root coverage between PRF membrane group and SCTG group at 6 month. The percentage of root coverage they found was 92.7% for PRF membrane group and 94.2% for SCTG group at 6 month. The percentage of complete root coverage was 72.7% for PRF membrane group and 77.3% for SCTG group at 6 month.

In our study comparatively more root coverage was achieved in both Group I and Group II possibly because of common use of orthodontic button on both side for holding flap in maximum coronally advanced position. Though not significant but more percentage of mean root coverage and complete root coverage at 3 month and 6 month in Group II compared to Group I showed advantage of use of PRF along with CAF + Orthodontic button. This finding could have been due to the placement of PRF between root surface and flap which in turn separated and stimulated the interface between flap and root surface. PRF acts as a healing and interpositional biomaterial which stimulates the gingival connective tissue on its whole surface with growth factors and impregnates the root surface with key matrix proteins for cell migration (fibronectin, vitronectin, and thrombospondin-1).

Pini Prato et al. (2005)[62] reported that postsurgical position of gingival margin relative to CEJ is an important factor for achieving complete root coverage. According to the observations of the authors, a direct relationship between GM location and CRC was found, the more coronal the level of gingival margin after suturing greater the probability of CRC. In our study, the optimal positioning of GM

relative to CEJ with the help of orthodontic button application and suspended suture seems to increase success of CRC in both the study groups. The progressive coronal improvement of the gingival margin level and the increased percentage of sites with CRC observed was due to a creeping attachment effect over time **(Matter 1980)**[69] and may be obtained by thick gingival tissue obtained after positioning of PRF membrane.

Contrary to our findings **Aroca et al. (2009)**[26] observed statistically significant increase in percentage root coverage and complete root coverage in CAF alone group as compared to CAF+PRF membrane group at 6 month. The percentage of root coverage was 80.7 ±14.7 % for CAF+PRF membrane group and 91.5 ± 11.4 % for CAF alone group at 6 month. The complete root coverage was 52.23% for CAF+PRF membrane group and 74.62% for CAF alone group at 6 month. **Aroca et al**. **(2009)**[26] stored PRF membrane at 4°C until surgery. Storage at 4°C can affect platelet morphology and studies have demonstrated that exposure of platelet to cold temperatures compromises the in vivo survival of the platelets. **Choukroun et al. (2000)**[63] advised PRF administration to the application site as soon as possible for optimal success of the treatment and same method was used in our study. PRF was prepared simultaneously with flap refection after orthodontic button application and PRF membrane was transferred to the recession site immediately.

Probing depth was included in this study as a parameter which potentially detect negative effect of therapy in terms of buccal probing depth. In group I, the mean PD at baseline, 3 month and 6 months was 1.70 ± 0.26 mm, 31.45 ± 0.50 mm and 1.34 ± 0.47 mm respectively. In group II, the mean PD at baseline, 3 and 6 months was 1.69 ± 0.46 mm and at 1.42 ± 0.49 mm and 1.37 ± 0.48mm respectively. At 3 months mean

PD reduction for group I was 0.25 ± 0.52 mm and for group II was 0.26± 0.66 mm. At 6 months, the mean PD reduction for group I was 0.36 ± 0.53 mm and for group II was 0.32 ± 0.70 mm. There was a statistically significant reduction in PD at 3 and 6 months compared to baseline and intergroup comparison at 6 month showed that the reduction in PD at 6 months was having non-significant difference.

Our results correlates to results of **Tunali et al. (2015)**[65] where authors found a significant reduction in PD after treatment in PRF +CAF group. PD decreased from 1.33 ± o.59 mm to 1.24 ±0.37 mm in PRF group at 6 months in their study. **Aroca et al. (2009)**[26] also found that mean PD in PRF group reduced from 1.41 ± 0.65 mm to 1.17 ± 0.41 mm in PRF membrane group and from 1.44 ± 0.6 mm to 1.14 ± 0.34 mm in CAF alone group at 6 month and this difference was statistically highly significant. **Thamaraiselvan (2015)**[66] observed that PD reduced from 1.40 ± 0.51mm to 1.00 ± 0.00 mm at 6 month in PRF membrane group which was statistically significant when compared to baseline. Authors also reported that there was a non-significant difference between CAF+PRF and CAF alone group at 6 month. **Ozcelik et al. (2011)**[30] obtained a mean PD reduction of 0.01 ± 0.69 mm in CAF group and 0.05 ± 0.70 mm in CAF+B group at 6 month which was non-significant when intragroup and intergroup comparisons were done. On the other hand no change in PD throughout the study for CAF+PRF group was observed by **Eren et al. (2014)**[68].

In this study, the mean CAL in Group I at baseline, 3 month and 6 month was 4.64 ± 0.72 mm, 2.18 ± 0.83 mm and 1.56 ± 0.62 mm respectively. In Group II, the mean CAL was 4.66 ± 0.77, 2.08 ± 0.74 and 1.53 ± 0.52 at baseline, 3 month and 6 month respectively.

At 3 months mean CAL gain in group I was 2.45 ± 0.79 mm and for group II was 2.58 ± 0.63 mm and this difference in CAL gain between groups was found to be non-significant. At 6 months the mean CAL gain for group I was 3.08 ± 0.80 mm and for group II was 3.13 ± 0.76 mm. This difference between the groups was non-significant.

Our results are in accordance with the results of the study done by **Ozcelik et al. (2011)**[30] where they found a mean CAL gain of 4.69 ± 1.20 mm where CAL reduced to 1.2 ± 1.0 mm from 5.9 ± 1.1 mm in CAF+B group and 3.93 ± 1.28 mm where CAL reduced to 1.8 ± 1.1 mm from 5.7 ± 1.1 mm in CAF alone group which was statistically significant at 6 month when compared to baseline. Authors found significant reduction in CAF+B group when intergroup comparison was done. **Khobragade et al. (2015)**[49] also achieved significantly higher CAL gain in CAF+B group when compared to CAF group. Mean CAL changed from 4.35 ± 0.69 to 1.96 ± 0.75 mm in CAF group and 4.27 ± 0.84 to 1.42 ± 0.69 mm in CAF + B group at 6 month. Using PRF membrane **Thamaraiselvan et al. (2015)**[66] observed a mean CAL gain of 2.50 ± 1.17 mm and in CAF group the mean CAL gain was 1.80 ± 0.91 mm at 6 month. Though both the treatment groups resulted in a statistically significant gain in CAL, it was not significant between the groups. On the contrary **Aroca et al. (2009)**[26] observed a significant CAL gain in CAF group as compared to CAF+PRF membrane group at 6 month. Mean CAL changed from 4.23 ± 1.56 to 1.76 ± 0.97 mm in PRF membrane group and 3.93 ± 1.43 to 1.37 ± 0.62 mm in CAF group at 6 month.

In our study there was a statistically significant gain in CAL in both the groups at 6 months when compared to baseline. Although higher CAL gain was observed in

Group II compared to Group I, it did not reach the level of significance when intergroup comparisons were done at 3 month and 6 month. Application of orthodontic buttons and suspended sutures maintains most possible coronal position of gingival margin maximizing the stabilization during early healing period. Attachment of the graft to the root surface through a combined effect of epithelial downgrowth and connective tissue attachment could be the possible reason associated with significant gain in CAL.

Comparatively more amount of CAL gain in Group II shows the beneficial effect of PRF where PRF membrane, used as a grafting material may offer an improved space making effect of the barrier which forms a conducive environment for cell events leading to periodontal regeneration. Statistically significant CAL gain at 6 month in both Group I and Group II might have been the result of true periodontal regeneration via new attachment or alternatively, healing by repair, which implies the presence of a long junctional epithelium between the newly regenerated tissues and the root surface. However in absence of histologic evidence, it is not possible to determine the type of attachment.

In this study, KTW at baseline, 3 month and 6 month in Group I was 2.56 ± 0.49, 3.21 ± 0.50 and 3.44 ± 0.64 respectively whereas in Group II it was 2.48 ± 0.52, 3.34 ± 0.60 and 3.62 ± 0.61 respectively.

At 3 month increase in KTW for Group I was 0.65 ± 0.55 mm and for Group II it was 0.86 ± 0.60 mm. The mean gain in KTW was 0.88 ± 0.75 mm for Group I and 1.14 ± 0.67 mm for Group II at 6 month. This difference of mean KTW gain between the

groups at 3 and 6 month followup intervals as compared to baseline was found to be statistically significant.

The findings of our study are in agreement with the findings of **Padma et al. (2013)**[67] who observed a statistically significant increase in mean width of keratinized gingiva in CAF with PRF membrane group and CAF alone group at 3 and 6 month postoperatively. The values increased from 2.94 ± 0.77 to 5.31 ± 0.79 at 3 month and 5.38 ± 1.67 at 6 month in CAF with PRF membrane group. Similarly values for CAF group increased from 2.44 ± 0.81 to 4.31 ± 0.70 at 3 months and 4.63 ± 0.81 at 6 months.

Tunali et al. (2015)[65] and **Eren at al. (2014)**[68] achieved non-significant difference in KTW when CAF+PRF membrane and CAF+CTG was compared. Thus showing a comparable advantage of PRF membrane as an alternative to CTG. **Tunali et al. (2015)**[65] found gain in KTW 2.33 ± 0.56 mm at baseline and 2.93 ± 0.70 at 6 month in L-PRF. In CTG group 2.43 ± 0.52 to 2.93 ± 0.71 mm. When compared to baseline statistically significant gain was found at 6 month whereas intergroup comparison was not significant. **Eren at al. (2014)**[68] found a highly statistical significant increase in KTW at 6 month as compared to baseline in both CAF with PRF membrane group and CAF with SCTG group. The mean KTW increased by 2.58 ± 1.37 mm to 3.51 ± 1.28 mm in CAF with PRF membrane group and 2.41 ± 1.20 to 3.63 ± 1.43 mm in CAF with SCTG group at 6 month. The intergroup comparison showed non-significant gain in KTW at 6 month.

On the contrary to the result obtained in our study **Aroca et al. (2009)**[26] achieved decreased KTW at 6 month as compared to baseline in both groups. The mean KTW

decreased from 2.78 ± 1.08 mm to 2.54 ± 0.85 mm in CAF+PRF membrane group and 2.85 ± 1.23 mm to 2.37 ± 0.89 mm in CAF alone group at 6 month. The difference between both the groups was insignificant at 6 month.

The presence of wider keratinized tissue not only favour aesthetics but also enhances patient comfort while brushing. In our study we observed a significant increase in the width of keratinized tissue over the period of 6 month in both the groups. This could be explained by a well-established fact that mucogingival line has an inherent tendency to regain its genetically determined position which is a slow and long lasting phenomenon. Although not significant more gain in Group II could have been the result of use of PRF membrane. PRF membrane is a living biomaterial unlike other inert barrier membranes which is yielded by a natural polymerization process during centrifugation. Thus, the natural fibrin architecture of the PRF facilitates the slow release of growth factors and matrix glycoproteins adding the beneficial effect.

In the literature several techniques to measure gingival thickness and distances between structures of periodontium have been documented which includes bone sounding or transgingival probing, probe transparency (TRAN), RVG (Parallel profile radiograph), ultrasonic device and most recently CBCT. Bone sounding or Transgingival probing is an invasive method which is carried out after administration of local anaesthesia which leads to patient discomfort. Also it fails to precisely determine the position of bone crest. By using TRAN method only subjective evaluation of gingival thickness can be carried out. **Alpister –Illueca (2004)**[70] developed parallel profile radiograph technique to determine dimension of dentogingival unit. But this technique is only applicable to maxillary central incisor

and less valid for other teeth due to superimposition of the image. **Muller and colleagues (1999)**[71] tried to determine gingival thickness by using an ultrasonic measuring device. However less reproducibility of the measurements and difficulty of application in different parts of the oral cavity make it a non-reliable technique. **Januario et al. (2008)**[31] introduced a novel and non-invasive soft tissue CBCT (ST-CBCT) technique to measure the dentogingival dimension by asking patient to wear a plastic retractor. This simple modification eliminates the drawback of conventional CBCT scan to discriminate soft tissues from hard tissues by retracting lip and cheek for better visualization. High quality, easy applicability and reproducibility make it a reliable method to measure and analyse the relationship of several structure of the periodontium.

Jia Hui Fu (2010)[51] compared and correlated clinical and CBCT measurements of both soft tissue and bone thickness. They found CBCT measurement as a reliable representation of the clinical thickness of both labial gingiva and bone. So CBCT imaging with plastic lip retractor was adopted for the measurement of gingival dimensions in our study.

Cheng Y F et al. (2007)[72] reported that a 6-month postoperative measurement period is sufficient to evaluate the stability of the gingival margin after a CAF. A healing period of 6 months was allowed before the results of surgical procedures were evaluated. After 6 month CBCT were taken and radiographic measurements were compared with the baseline CBCT data.

On CBCT, the distance between the gingival margin and the alveolar bone crest (GMB) was measured at baseline and 6 month. The mean GMB was 2.36 ± 0.55 mm

in Group I and 2.47 ± 0.56 mm in Group II at baseline. At 6 month the mean GMB was 3.58 ± 0.51 mm in Group I and 3.77 ± 0.46 mm in Group II. The mean GMB increased by 1.22 ± 0.53 mm in Group I and 1.30 ± 0.41 mm in Group II at 6 month compared to baseline. Although intragroup comparison showed statistically significant increase, intergroup comparison failed to reach the level of significance at 6 month.

Biologic width is an important clinical parameter for aesthetic surgical procedures. It is difficult for the clinician to precisely determine the biologic width clinically due to a great variation in this dimension. **Januario et al. (2008)**[31] proposed a non-invasive technique to measure this distance on CBCT. In our study the mean distance from alveolar bone crest and gingival margin increased in both the groups at 6 month. This radiographic finding is in accordance with the clinical finding obtained in this study where a statistically significant CAL gain in both Group I and Group II was observed at 6 month.

Baseline gingival thickness plays a critical in root coverage procedures in deciding the prognosis of the treatment. In this study gingival thickness was evaluated at three different points keeping alveolar bone crest as a reference. The gingival thickness was measured 1mm apical to alveolar bone crest (GT1), at the level of alveolar bone crest (GT2) and 1 mm coronal to alveolar bone crest (GT3) on CBCT at baseline and 6 month.

The mean GT1 increased from 1.15 ± 0.56 mm to 1.85 ± 0.53 mm in Group I and 1.06 ± 0.31 to 2.30 ± 0.61 mm in Group II at 6 month. The mean change in the GT1 was 0.69 ± 0.42 mm in Group I and 1.24 ± 0.63 mm in Group II at 6 month. This

difference was statistically highly significant. The mean GT2 increased from 1.47 ± 0.45 mm to 2.02 ± 0.36 mm in Group I and 1.29 ± 0.35 to 2.44 ± 0.61 mm in Group II at 6 month. The mean change in the GT2 was 0.55 ± 0.26 mm in Group I and 1.14 ± 0.56 mm in Group II at 6 month. This difference was statistically highly significant. The mean GT3 increased from 1.11 ± 0.36 mm to 1.73 ± 0.39 mm in Group I and 1.10 ± 0.35 to 2.23 ± 0.65 mm in Group II at 6 month. The mean change in the GT3 was 0.61 ± 0.32 mm in Group I and 1.13 ± 0.67 mm in Group II at 6 month. This difference was also statistically highly significant. Overall there was statistically significant increase in the gingival thickness in Group II at 6 month compared to baseline.

Following the same trend **Thamaraiselvan et al. (2015)**[66] also achieved significant increase in the gingival thickness in CAF+PRF membrane group compared to CAF alone the groups at 6 month. The mean increase in the thickness was 0.30 ± 0.10 in PRF membrane group and 0.03 ± 0.04 in CAF group at 6 month. On the contrary **Gupta et al. (2015)**[48] found a non-significant increase in the gingival thickness in CAF+PRF membrane group and CAF alone group at 6 month. The mean gingival thickness increased by 0.07 ± 0.03 mm in CAF+PRF membrane group and 0.04 ± 0.05 mm in CAF alone group at 6 month.

However, direct comparisons can-not be done with findings of **Thamaraiselvan et al. (2015)**[66] and **Gupta et al. (2015)**[48] because of the difference in the protocol and technique used for the measurement of gingival thickness.

Cairo et al. (2016)[39] found a positive relationship between baseline gingival thickness and type of treatment. He observed that sites with thick periodontal biotype (>0.8

mm) shows similar clinical outcomes and better final aesthetics when CAF is used alone as compared to CAF+CTG. In our study the treatment sites had thick periodontal biotype (≥ 1.06 mm) which could be the reason for obtaining good percentage of root coverage. We observed a highly significant increase in the gingival thickness in Group II as compared to Group I at 6 month. This finding can be attributed to the biologic properties of PRF. The increase in soft tissue thickness could have been the result of influence of growth factors from PRF stimulating the proliferation of gingival and periodontal ligament fibroblasts.

Significant increase in the gingival thickness was also observed in Group I when compared to baseline. This could be the result of split-full-split thickness flap design used in this study. The full thickness flap elevated apical to the root exposure preserves the maximum thickness of soft tissue which resides on the denuded root surface.

Restoration of the aesthetic soft tissue contour is the ultimate goal of the gingival recession treatment. Complete root coverage does not always mean good aesthetic appearance. **Cairo et al. (2009)**[57] introduced a Root Coverage Aesthetic Score (RES) in which not only the gingival margin but also various aspects such as marginal tissue contour, soft tissue texture, mucogingival junction alignment and colour can be assessed. That is why this score was included to evaluate the treatment outcome. Also, VAS scale was included to assess postoperative discomfort and patient's perception about the aesthetic.

The RES scores for both groups were high. The RES score for Group I was 8.69 ± 1.46 and for Group II was 8.84 ± 1.41. This difference was found to be statistically non-significant.

Post-operative discomfort was evaluated 1 week after the surgery on 100 mm visual analog scale (VAS-P). The VAS-P scores for Group I was 70.0 ± 29.91 mm and that for Group II was 65.0 ± 28.56 mm. This difference between the two groups was found to be statistically non-significant. Whereas VAS-E score evaluated patient satisfaction with aesthetic. VAS-E score for Group I was 72.5 ± 25.52 and for Group II was 75.0 ± 25.64, this difference was also statistically non-significant.

Significantly high RES and VAS-E score was obtained by CAF+B group compared to CAF alone group in the study done by **Ozcelik et al. (2011)**[30]. They found mean RES score of 8.65 ± 1.47 in CAF+B group and 7.43 ± 1.56 in CAF group. The mean score of VAS-E in CAF+ B group was 8.18 ± 0.73 and 7.15 ± 1.18 in CAF group. However, a non-significant difference was seen in mean VAS-P score in both the groups which was 5.31 ± 1.52 in CAF+B group and 5.70 ± 1.59 in CAF group. **Khobragade et al. (2016)**[49] found mean RES score of 8.76 ± 1.56 in CAF+B group and 7.57 ± 1.75 in CAF group. This difference was statistically highly significant. VAS-E score was 90.0 ± 20.51 in CAF+B group and 70.0 ± 25.13 in CAF group. This difference was also statistically highly significant. Whereas there was no statistical difference in the VAS-P scores in both the groups. VAS-P score was 57.5 ± 33.54 in CAF+B group and 62.5 ± 31.6 in CAF group.

To assess early wound healing property of PRF, **Jankovic et al. (2012)**[46] assessed the postoperative discomfort by recording Healing index and they observed an improved

healing in CAF+PRF membrane group compared to CAF+CTG group. Also, the pain intensity was statistically higher for CAF+CTG group in the first 7 days after surgery compared to CAF+PRF membrane group.

In our study, RES and VAS-E scores were high in both the groups and when intergroup comparison was done showed a non-significant difference indicating satisfactory outcome. This could be the result of using oblique incision in the interdental area. The oblique incision not only mimic the shape of the papilla but also facilitates precise repositioning of the surgical papilla over the de-epitheliazed anatomic papilla thus providing good aesthetics.

When factors such as the success rate for root coverage procedures and patient comfort after surgery are considered, Modified CAF+Orthodontic button with or without PRF showed promising results. Studies have emphasized that gingival tissue thickness is essential and seems to improve clinical results[73.74]. Significantly higher gain in Gingival thickness in Group II where PRF membrane was used, promotes the use of PRF as healing and inductive interpositional biomaterial along with CAF. Similar is the case with Keratinized tissue width. As in present study no histologic evaluation was performed, the effect of PRF on the overall regenerative capacity remain undetermined. Observation of the study supports the clinical value of PRF use. The positive tendency for PRF uses needs to be evaluated in studies involving a larger number of subjects over a longer duration. Direct comparison of clinical results and materials may lead to invalid conclusions. Study design, differences in patient population, healing pattern, microbial pathogens and disease activity between populations makes it difficult to compare clinical result when dealing with in vivo human trials.

CONCLUSION

The present randomized, controlled clinical study clinical and CBCT study was undertaken to compare the effectiveness of coronally advanced flap with orthodontic button application with and without platelet rich fibrin membrane in treatment of multiple gingival recession defects clinically & radiographically by CBCT. 20 systemically healthy subjects with bilateral Miller's Class I and/or Class II multiple gingival recession defects were enrolled for the study. Baseline clinical measurements included Plaque index, Gingival index, Gingival recession depth, Probing depth, Clinical attachment level and Keratinized tissue width whereas

distance between gingival margin and alveolar bone crest (GMB) and gingival thickness (GT) were assessed radiographically by CBCT at baseline and 6 month. At the time of surgery, defects were randomly assigned to either Group I i.e. Control Group (CAF+B) or Group II i.e. test group (CAF + B+PRF membrane). All the baseline clinical parameters were assessed at 3 and 6 months post-operatively.

During the course of study, healing was uneventful in both Group I and Group II, without any signs of infection or complications. No clinical evidence of undesirable, immune response was detected and no evidence of tissue reaction was seen.

The results were evaluated over a time span of 6 months. The efficacy of treatment modality was investigated through statistical analysis.

Throughout the study the PI and GI score was less than one, indicating that patients had maintained good oral hygiene through the complete duration of study. GRD reduction in Group I and Group II was significantly greater at 3 month and 6 month when compared to baseline. Group I showed mean reduction of 2.72 ± 0.72 mm and Group II showed mean reduction of 2.81 ±0.63 mm at 6 month. But when both treatment modalities (CAF+B and CAF+B+PRF membrane) were compared, reduction in GRD at 3 month and 6 month was found non-significant.

At 6 months the percentage of root coverage achieved in Group I was 93.17 ± 13.23 % and in Group II was 95.68 ± 10.13%. This difference was found to be statistically non-significant when intergroup comparisons were done. Also, complete root coverage was achieved in 59 out of 75 (78.66%) treated gingival recession

defects in Group I and 62 out of 75 (82.66%) treated gingival recession defects in Group II at 6 month. Thus Group II exhibited statistically more root coverage than Group I.

The mean CAL gain was 3.08 ± 0.80 mm for Group I and 3.13 ± 0.76 mm for Group II at 6 month. This difference between the groups was non-significant.

The mean gain in KTW was 0.88 ± 0.75 mm for Group I and 1.14 ± 0.67 mm for Group II at 6 month. This difference of mean KTW gain between the groups at 6 month follow-up intervals as compared to baseline was found to be statistically significant.

The mean distance between the gingival margin and the alveolar bone crest increased by 1.22 ± 0.53 mm in Group I and 1.30 ± 0.41 mm in Group II at 6 month which was assessed by CBCT. Although intragroup comparison showed statistically significant increase, intergroup comparison failed to reach the level of significance at 6 month.

Gingival thickness (GT) was assessed at three different points on CBCT. The mean increase in the GT1 was 0.69 ± 0.42 mm in Group I and 1.24 ± 0.63 mm in Group II at 6 month. The mean increase in the GT2 was 0.55 ± 0.26 mm in Group I and 1.14 ± 0.56 mm in Group II whereas the mean GT3 increased by 0.61 ± 0.32 mm in Group I and 1.13 ± 0.67 mm in Group II at 6 month. Overall there was statistically significant increase in the gingival thickness in Group II compared to Group I at 6 month.

From the analysis of results, following conclusions were drawn:

1. Both treatment modalities i.e. CAF+B and CAF +B+PRF membrane are effective in treatment of Miller's Class I and Class II multiple gingival recession defects.
2. CAF + B and CAF+B+PRF membrane showed comparable gingival recession depth reduction, clinical attachment level gain and percentage of root coverage at 6 months, compared to CAF+B.
3. CAF + B +PRF membrane showed statistically significant increase in keratinized tissue width and gingival thickness compared to CAF+B at 6 month.
4. Post-operative discomfort was non-significant in both treatment modalities.
5. CAF+ B and CAF+ B +PRF membrane showed comparable results in terms aesthetic outcome at 6 month.

It is concluded within the limits of study, CAF+B+PRF membrane could be beneficial in achieving better results in terms of GRD reduction, percentage of root coverage, CAL gain, increase in KTW, gingival thickness and aesthetic outcome.

LIMITATIONS

The following limitations were observed in the present study:

1. The sample size in the present study was limited to 20 bilateral furcation defects. A larger sample size would be desirable so as to substantiate the results.
2. Long term analysis is needed to determine the stability of the results.

3. Ethical considerations as well as patient's non-acceptance restricted the re-entry surgery to assess histological examination.
4. The operator was the assessor in the present study and there were no blinded examinations. Therefore possibility of operator bias to some extent cannot be ruled out.

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Table No. 1: Plaque index (PI) at different time intervals

	Baseline	3 Month	6 Month
Mean	0.92	0.94	0.94
SD	0.11	0.11	0.13
p-value	0.902 (NS)		

SD: Standard Deviation

NS: Non significant

Table No. 2: Gingival index (GI) at different time intervals

	Baseline	3 month	4 month
Mean	0.68	0.72	0.70
SD	0.26	0.25	0.24
p-value	0.816 (NS)		

SD: Standard Deviation

NS: Non significant

Table No. 3: Descriptive statistics of Gingival Recession Depth (GRD) (in mm) at baseline, 3 month and 6 month in Group I and Group II

Time	**Group I (n = 75)**	**Group II (n = 75)**
	Mean ± SD(mm)	**Mean ± SD (mm)**
Baseline	2.93 ± 0.77	2.98 ± 0.76
3 month	0.73 ± 0.72	0.62 ± 0.71
6 month	0.21 ± 0.41	0.17 ± 0.38

SD: Standard Deviation

Table No. 4: Comparison of Mean Gingival Recession Depth (GRD) (in mm) at baseline, 3 month & 6 month in Group I and Group II

Comparison	Group I		Group II	
	Mean difference (mm)	p-value	Mean difference (mm)	p-value
Baseline - 3 month	2.20	<0.001 (HS)	2.36	<0.001 (HS)
Baseline - 6 month	2.72	<0.001 (HS)	2.81	<0.001 (HS)
3 month - 6 month	0.52	<0.001 (HS)	0.45	<0.001 (HS)

HS: Highly Significant

Table No. 5: Comparison of mean change in Gingival Recession Depth (GRD) (in mm) between Group I and Group II at different time intervals

Time	Group I	Group II	p-value
At 3 month	2.20 ±0.69	2.36± 0.62	0.1423 (NS)
At 6 month	2.72 ±0.72	2.81 ±0.63	0.4022 (NS)
3 month- 6 month	0.52 ±0.57	0.45 ±0.52	0.5350 (NS)

NS: Non Significant

Table No. 6: Descriptive statistics of Percentage Root Coverage at 3 month & 6 month

Time	Group I (n = 75)	Group II (n = 75)
	Mean ± SD (%)	Mean ± SD (%)
3 month	79.49 ± 21.83	80.15 ± 19.65
6 month	93.17 ± 13.23	95.68 ± 10.13
p-value	<0.0001,HS	<0.0001,HS

SD= Standard Deviation

Table No. 7: Comparison of Percentage Root Coverage (%RC) between Group I and Group II at 3 and 6 month

Time	Group I	Group II	p-value
3 month	79.49 ± 21.83	80.15 ± 19.65	0.8170 (NS)
6 month	93.17 ± 13.23	95.68 ± 10.13	0.2925 (NS)

NS: Non Significant

Table No. 8: Descriptive statistics of Percentage Complete root coverage (CRC) at 3 month & 6 month in Group I and Group II

Time	Group I (%)	Group II (%)
3 month	42.66	50.66
6 month	78.66	82.66
p-value	<0.0001 (HS)	<0.0001 (HS)

HS: Highly Significant

Table No. 9: Comparison Complete Root Coverage (CRC) between Group I and Group II at 3 and 6 month

Time	Group I	Group II	p-value
3 month	42.66	50.66	0.326 (NS)
6 month	78.66	82.66	0.535 (NS)

NS: Non Significant

Table No. 10: Descriptive statistics of Probing Depth (PD) (in mm) at baseline and 3 month & 6 month in Group I and Group II

Time	Group I (n = 75)	Group II (n = 75)
	Mean ± SD (mm)	Mean ± SD (mm)
Baseline	1.70 ± 0.26	1.69 ± 0.46
3 months	1.45 ± 0.50	1.42 ± 0.49
6 months	1.34 ± 0.47	1.37 ± 0.48

SD: Standard Deviation

Table No. 11: Comparison of Mean Probing Depth (PD) (in mm) at baseline 3 month & 6 month in Group I and Group II

Comparison	Group I		Group II	
	Mean difference	p-value	Mean difference	p-value
Baseline - 3 month	0.25	<0.001 (HS)	0.26	0.001 (HS)
Baseline - 6 month	0.36	0.001 (HS)	0.32	0.001 (HS)
3 month - 6 month	0.10	0.004 (HS)	0.053	0.321 (NS)

HS: Highly Significant

NS: Non Significant

Table No. 12: Comparison of mean change in Probing Depth (PD) (in mm) between Group I and Group II at different time intervals

Time	Group I	Group II	p-value
At 3 month	0.25 ±0.52	0.26 ± 0.66	0.6894 (NS)
At 6 month	0.36 ±0.53	0.32± 0.70	0.9950 (NS)
3 month – 6 month	0.10 ±0.31	0.053± 0.46	0.4571 (NS)

NS: Non Significant

Table No. 13: Descriptive statistics of Clinical Attachment Level (CAL) (in mm) at baseline, 3 month & 6 month in Group I and Group II

Time	Group I (n = 75)	Group II (n = 75)
	Mean ± SD (mm)	Mean ± SD (mm)
Baseline	4.64 ± 0.72	4.66 ± 0.77
3 month	2.18 ± 0.83	2.08 ±0.74
6 month	1.56 ±0.62	1.53± 0.52

SD= Standard Deviation

Table No. 14: Comparison of Mean Clinical Attachment level (CAL) (in mm) at baseline, 3 month & 6 month post operatively in Group I and Group II

Comparison	Group I		Group II	
	Mean difference (mm)	p-value	Mean difference (mm)	p-value
Baseline – 3 month	2.45	<0.001 (HS)	2.58	<0.001 (HS)
Baseline – 6 month	3.08	<0.001 (HS)	3.13	<0.001 (HS)
3 month – 6 month	0.62	<0.001 (HS)	0.54	<0.001 (HS)

HS: Highly Significant

Table No. 15: Comparison of mean change in Clinical Attachment Level (CAL) (in mm) between Group I and Group II at different time intervals

Time	Group I	Group II	t-value/ Z-value	p-value
At 3 month	2.45 ±0.79	2.58 ±0.63	1.802	0.0716 (NS)
At 6 month	3.08 ±0.80	3.13± 0.76	0.485	0.6275 (NS)
3 month – 6 month	0.62 ±0.65	0.54 ±0.64	0.412	0.6805 (NS)

NS: Non Significant

Table No. 16: Descriptive statistics of Keratinized Tissue Width (KTW) (in mm) at baseline, 3 month & 6 month in Group I and Group II

Time	Group I (n = 75)	Group II (n = 75)
	Mean± SD (mm)	Mean ±SD
Baseline	2.56± 0.49	2.48± 0.52
3 month	3.21± 0.50	3.34± 0.60
6 month	3.44± 0.64	3.62± 0.61

SD= Standard Deviation

Table No. 17: Comparison of Keratinized Tissue Width (KTW) (in mm) at baseline 3 month & 6 month post operatively in Group I and Group II

Comparison	Group I		Group II	
	Mean difference (mm)	p-value	Mean difference (mm)	p-value
Baseline - 3 month	0.65	<0.001 (HS)	0.86	<0.001 (HS)
Baseline - 6 month	0.88	<0.001 (HS)	1.14	<0.001 (HS)
3 month - 6 month	0.22	0.214 (NS)	0.28	<0.001 (HS)

HS: Highly Significant

NS: Non Significant

Table No. 18: Comparison of mean change in Keratinized Tissue Width (KTW) (in mm) between Group I and Group II at different time intervals

Time	Group I	Group II	p-value
3 month	0.65 ±0.55	0.86 ±0.60	0.0412 (S)
6 month	0.88 ±0.75	1.14 ±0.67	0.0309 (S)
3 month - 6 month	0.22 ±0.42	0.28 ±0.48	0.4372 (NS)

S: Significant

NS: Non significant

Table No. 19: Descriptive statistics of GMB at baseline & 6 month in Group I and Group II

Time	Group I (n = 75)	Group II (n = 75)
	Mean ± SD (mm)	Mean ±SD (mm)
Baseline	2.36± 0.55	2.47± 0.56
6 months	3.58± 0.51	3.77± 0.46
p-value	<0.0001 (HS)	<0.0001 (HS)

SD: Standard Deviation

HS: Highly Significant

Table No. 20: Comparison of mean change in GMB between Group I and Group II at different time intervals

Time	Group I	Group II	Z-value	p-value
6 month	1.22 ± 0.53	1.30 ± 0.41	1.137	0.2554 (NS)

NS: Non Significant

Table No. 21: Descriptive statistics of GT1 at baseline & 6 month in Group I and Group II

Time	Group I (n = 75)	Group II (n = 75)
	Mean ± SD (mm)	Mean ± SD (mm)
Baseline	1.15 ± 0.56	1.06 ± 0.31
6 month	1.85 ± 0.53	2.30 ± 0.61
p-value	<0.0001 (HS)	<0.0001 (HS)

SD: Standard Deviation

HS: Highly Significant

Table No. 22: Comparison of mean change in GT1 between Group I and Group II at 6 month

Time	Group I	Group II	Z-value	p-value
6 month	0.69 ±0.42	1.24 ±0.63	5.509	<0.001 (HS)

HS: Highly Significant

Table No. 23: Descriptive statistics of GT2 at baseline & 6 month post operatively in Group I and Group II

Time	Group I (n = 75)	Group II (n = 75)
	Mean± SD (mm)	**Mean± SD (mm)**
Baseline	1.47± 0.45	1.29± 0.35
6 months	2.02± 0.36	2.44±0.61
t-value	17.9138	17.6116
p-value	<0.0001 (HS)	<0.0001 (HS)

SD: Standard Deviation

HS: Highly Significant

Table No. 24: Comparison of mean change in GT2 between Group I and Group II at 6 month

Time	Group I	Group II	Z-value	p-value
6 month	0.55 ±0.26	1.14 ±0.56	6.454	<0.001 (HS)

HS: Highly Significant

Table No. 25: Descriptive statistics of GT3 at baseline & 6 month in Group I and Group II

Time	Group I (n = 75)		Group II (n = 75)	
	Mean ± SD (mm)		Mean ± SD (mm)	
Baseline	1.11	0.36	1.10	0.35
6 months	1.73	0.39	2.23	0.65
p-value	<0.0001 (HS)		<0.0001 (HS)	

SD: Standard Deviation

HS: Highly Significant

Table No. 26: Comparison of mean change in GT3 between Group I and Group II at 6 month

Time	Group I	Group II	Z-value	p-value
6 month	0.61 ±0.32	1.13 ± 0.67	4.999	<0.001 (HS)

HS: Highly Significant

Table No. 27: Distribution of Root coverage aesthetic score (RES) and VAS score at 6 month in Group I and Group II

Variable	Group I	Group II	t-value	p-value
RES	8.69 ±1.46	8.84 ± 1.41	0.86246	0.5332 (NS)
VAS-P	70.0 ± 29.91	65.0 ± 28.56	0.586	0.5581 (NS)
VAS- E	72.5 ± 25.52	75.0 ± 25.64	0.313	0.7546 (NS)

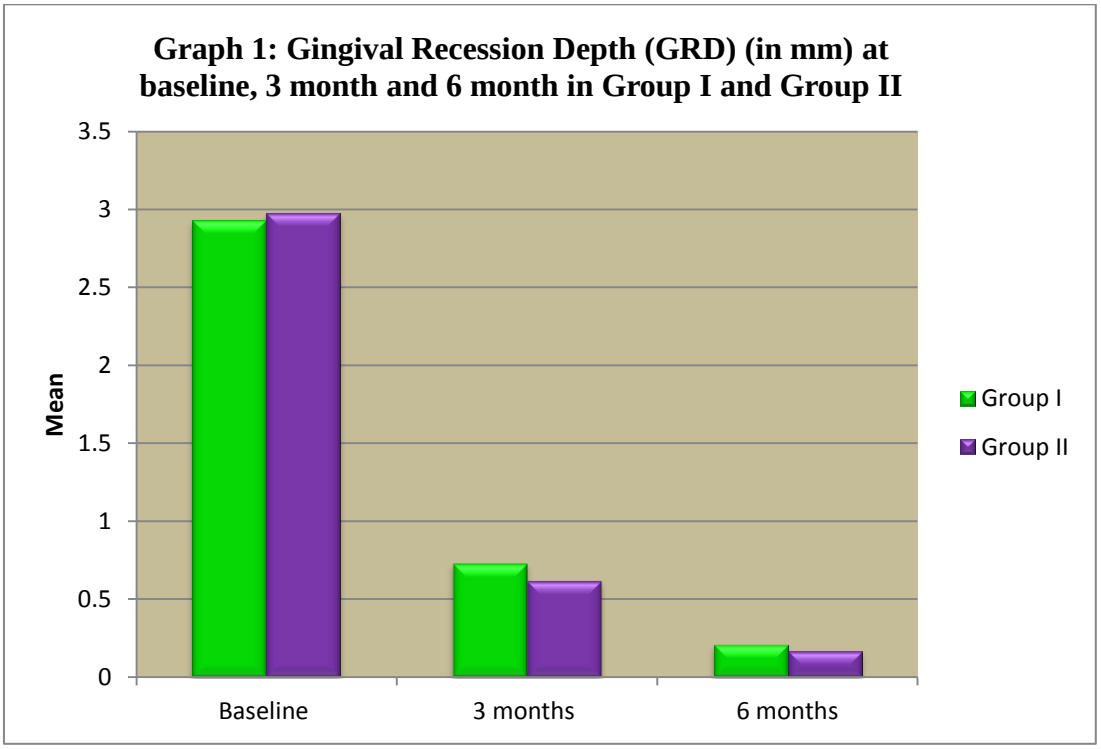
NS: Non Significant

VAS: Visual Analog Scale

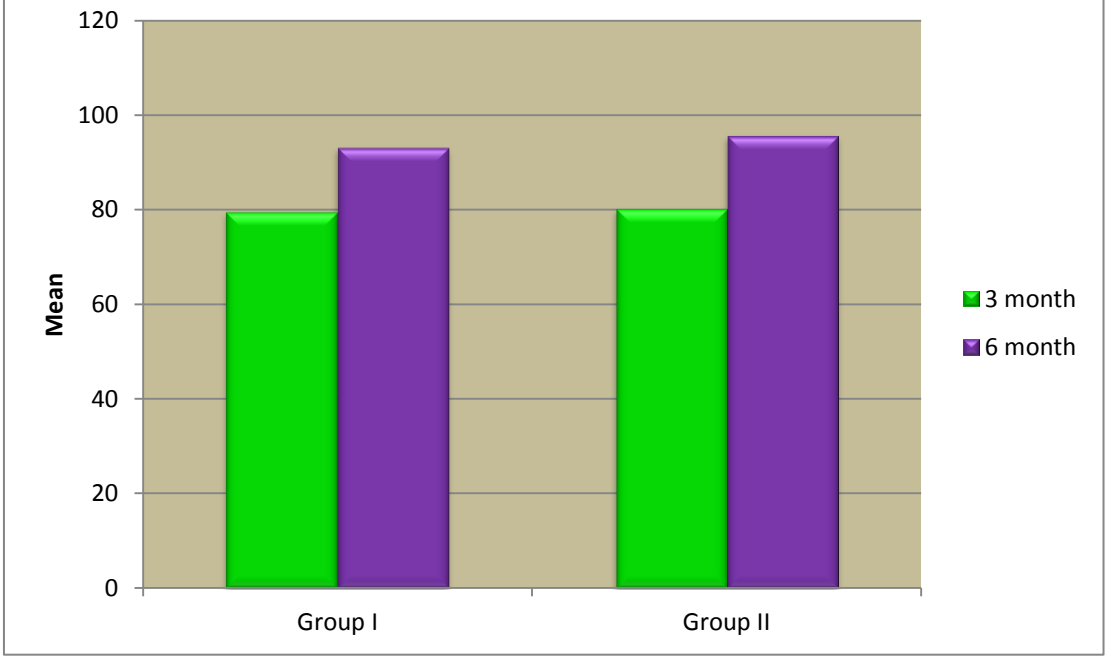
VAS-P: Pain at immediate post-operative period

VAS-E: Aesthetic satisfaction at 6 month

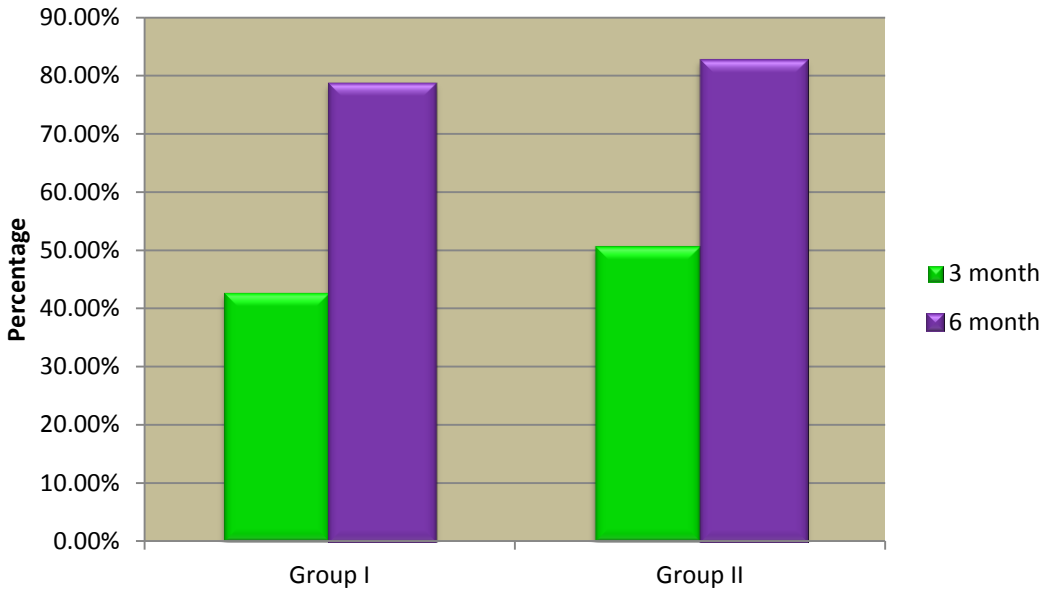
Graph 1: Gingival Recession Depth (GRD) (in mm) at baseline, 3 month and 6 month in Group I and Group II



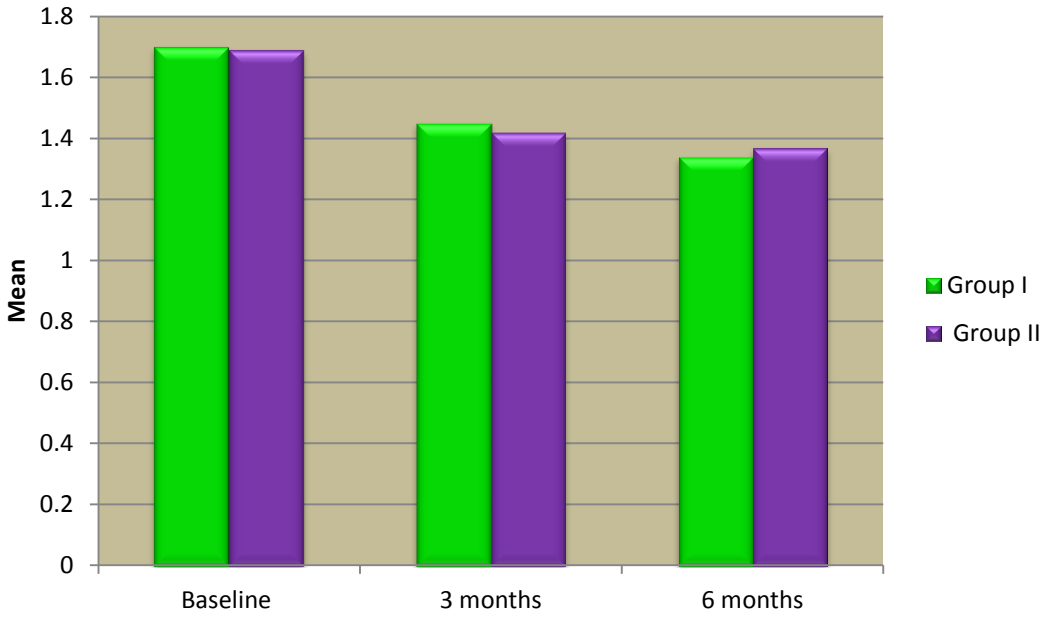
Graph 2: Percentage Root Coverage at 3 month & 6 month



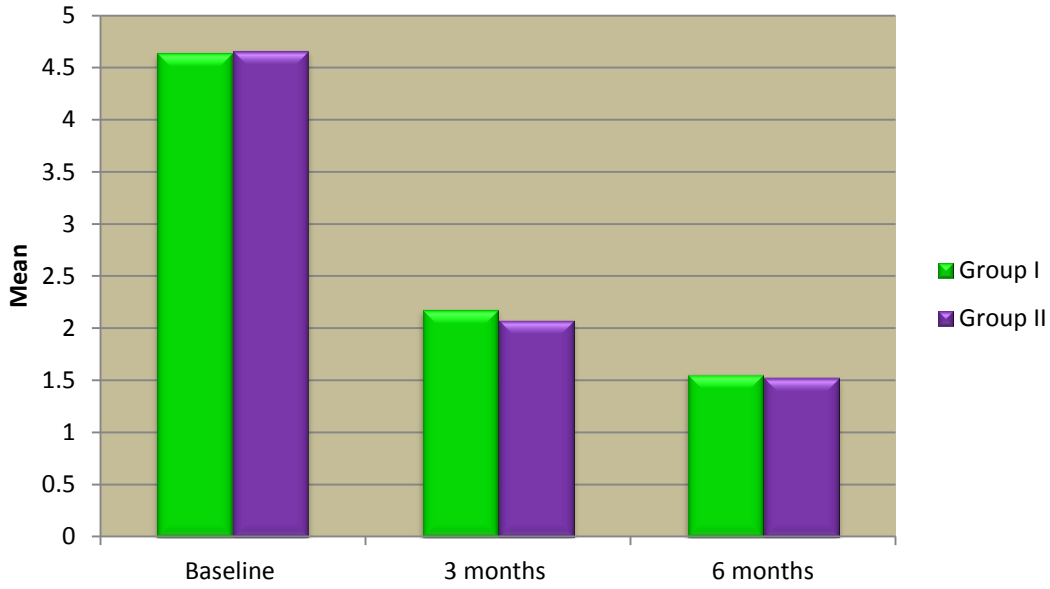
Graph 3: Complete root coverage (CRC) at 3 month & 6 month in Group I and Group II



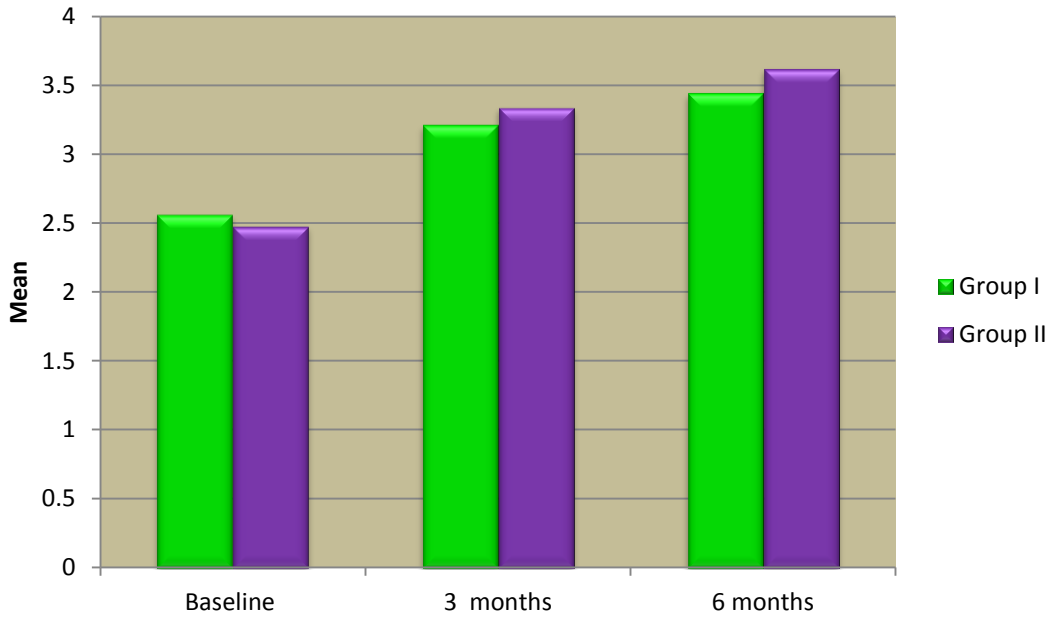
Graph 4: Probing Depth (PD) (in mm) at baseline and 3 month & 6 month post operatively in Group I and Group II



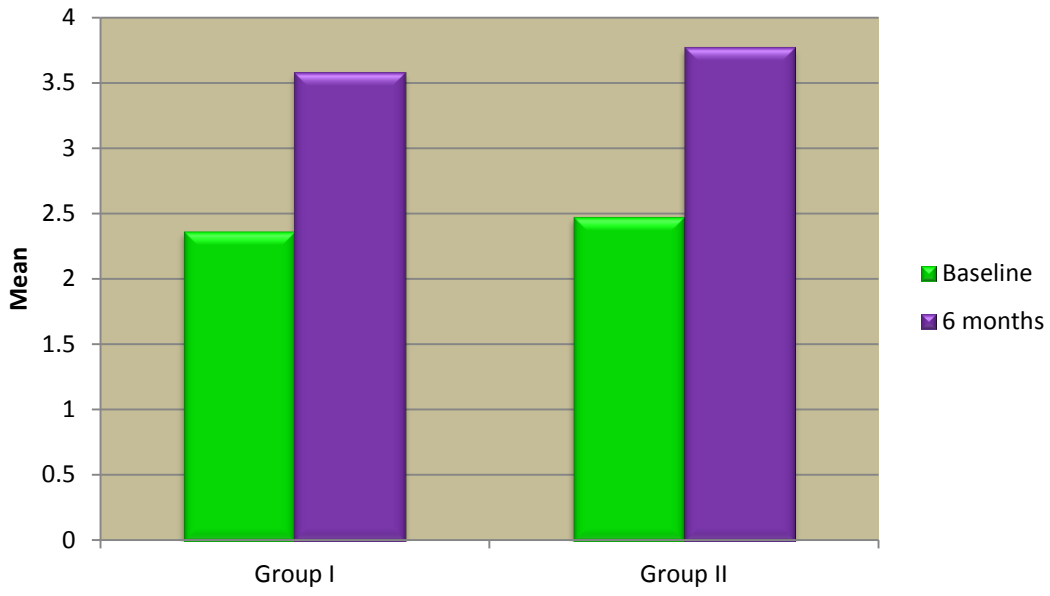
Graph 5: Clinical Attachment Level (CAL) (in mm) at baseline, 3 month & 6 month in Group I and Group II



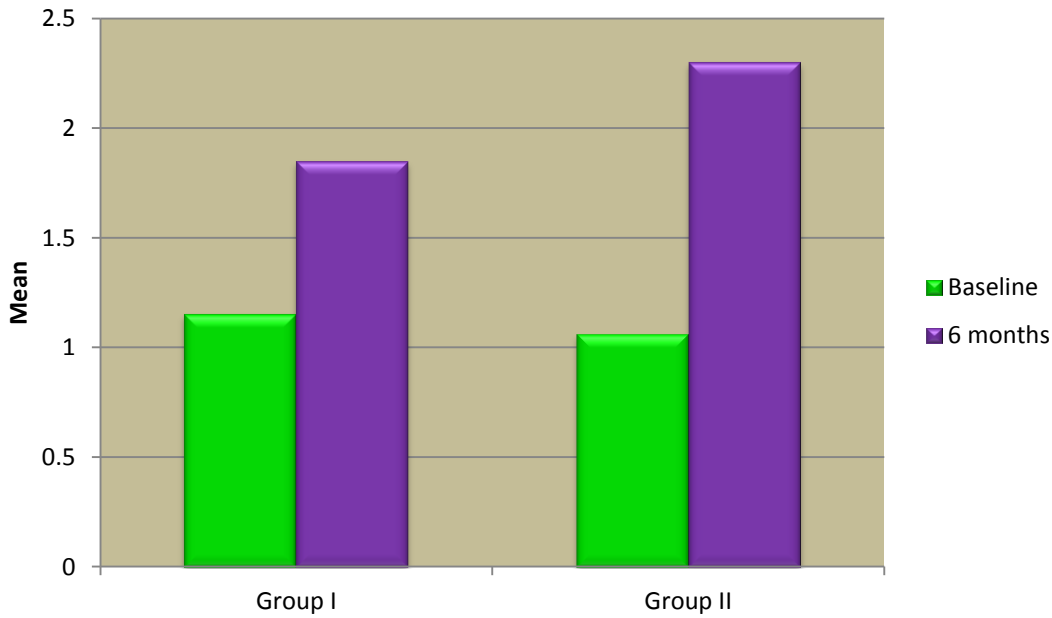
Graph 6: Keratinized Tissue Width (KTW) (in mm) at baseline, 3 month & 6 month in Group I and Group II



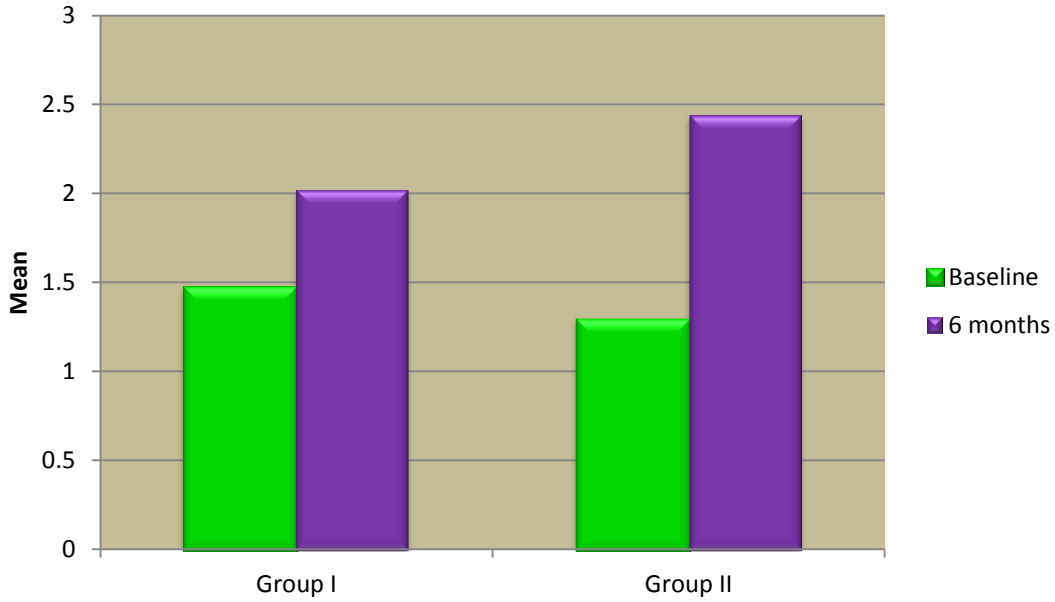
Graph 7: GMB (in mm) at baseline & 6 month in Group I and Group II



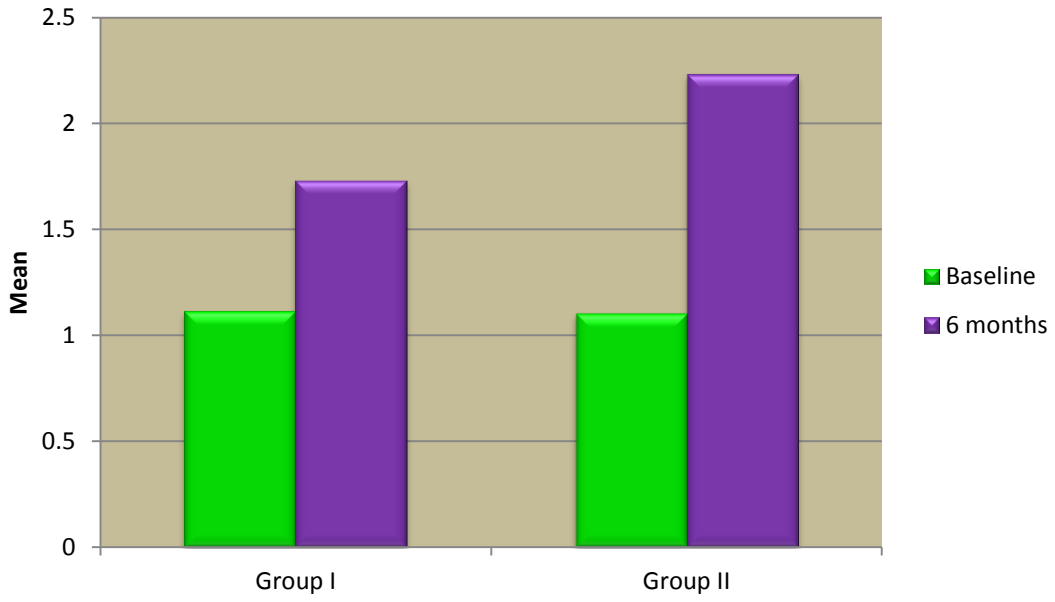
Graph 8: GT1 (in mm) at baseline & 6 month in Group I and Group II



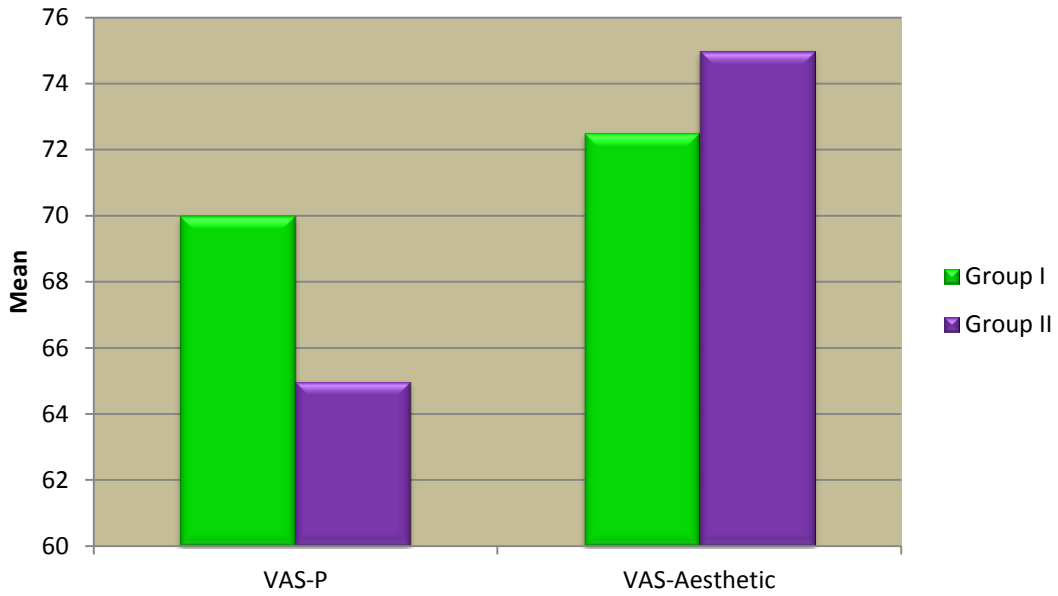
Graph 9: GT2 (in mm) at baseline & 6 month in Group I and Group II



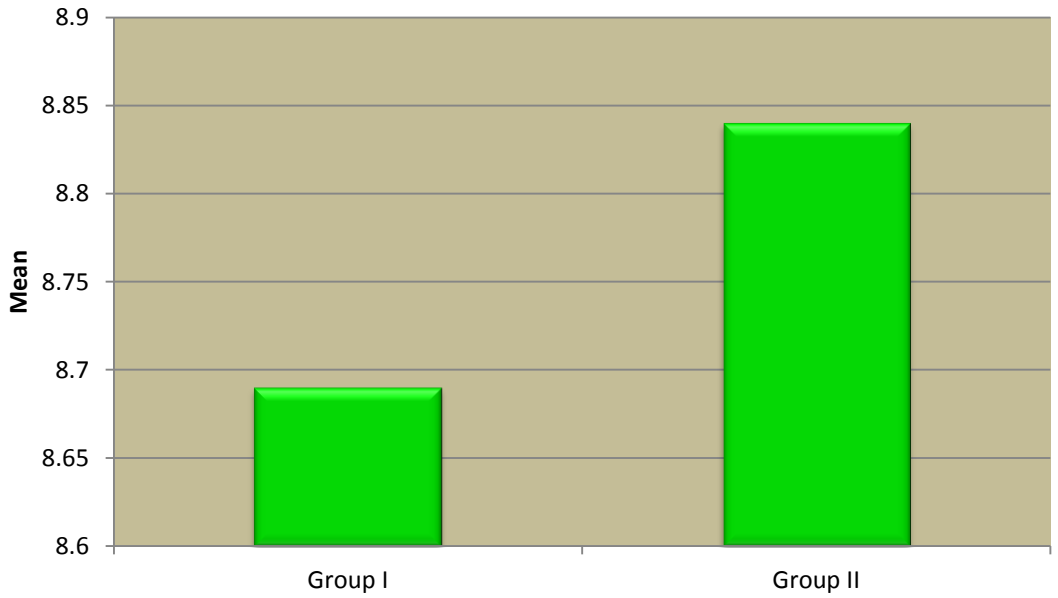
Graph 10: GT3 (in mm) at baseline & 6 month in Group I and Group II



Graph 11: VAS-P and VAS-Aesthetic at 6 month in Group I and Group II



Graph 12: Root coverage aesthetic Score at 6 month in Group I and Group II



MASTER CHART

PLAQUE INDEX

Sr. No.	Baseline	3 month	6 month
1.	1	0.8	1
2.	1	1	1
3.	0.83	1	1
4.	0.66	1	1
5.	1	1	1
6.	0.83	1	0.83
7.	1	1	1
8.	0.66	0.83	1
9.	1	1	0.66
10.	1	1	0.5
11.	1	1	1
12.	1	0.66	1
13.	0.83	1	1
14.	1	1	1
15.	1	0.66	1
16.	1	1	1
17.	0.83	1	1
18.	1	1	1
19.	1	1	0.83
20.	0.83	0.83	1

GINGIVAL INDEX

Sr. No.	Baseline	3 month	6 month
1.	1	0.5	1
2.	0.33	0.83	0.5
3.	0.66	0.5	0.5
4.	1	1	0.66
5.	0.83	1	1
6.	0.5	1	0.5
7.	0.66	0.5	0.33
8.	1	0.5	1
9.	0.5	1	0.66
10.	1	1	0.83
11.	0.5	0.5	0.5
12.	0.5	0.33	1
13.	1	1	1
14.	0.33	0.5	0.5
15.	0.5	0.5	0.5
16.	1	1	0.66
17.	0.5	0.5	0.5
18.	1	0.83	1
19.	0.5	0.5	1
20.	0.33	1	0.5

CLINICAL PARAMETERS

BASELINE

Group I CAF+B						Group II CAF+PRF membrane+B					
Sr. No.	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**	**Sr. No.**	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**
1.	11	3	1	4	3	**1.**	21	3	1	4	3
	12	3	1	4	3		22	3	1	4	3
	13	3	2	5	3		23	4	2	6	2
	14	3	1	4	2		24	3	1	4	2
	15	3	1	4	2		25	2	2	4	2
2.	23	3	2	5	3	**2.**	13	3	2	5	3
	24	3	2	5	3		14	3	2	5	3
3.	21	3	1	4	3	**3.**	11	3	1	4	3
	22	2	1	3	3		12	2	1	3	4
	23	4	1	5	2		13	4	2	6	3
	24	2	2	4	3		14	2	2	4	2
	25	2	2	4	2		15	2	2	4	2
4.	23	3	2	5	2	**4.**	13	4	1	5	2
	24	2	1	3	3		14	2	1	3	2
5.	21	3	2	5	3	**5.**	11	3	2	5	3
	22	3	2	5	3		12	3	2	5	3
	23	4	2	6	3		13	4	2	6	3
	24	4	2	6	2		14	3	2	5	2
	25	2	2	4	2		15	3	2	5	2
6.	22	4	1	5	3	**6.**	13	4	2	6	3
	23	3	1	4	2		14	3	1	4	2
	24	3	2	5	3		15	3	2	5	3
7.	21	2	2	4	3	**7.**	11	2	2	4	3
	22	2	2	4	3		12	2	2	4	3
	23	3	2	5	2		13	3	2	5	2
8.	21	3	1	4	3	**8.**	11	3	1	4	3
	22	2	2	4	3		12	2	2	4	3
	23	4	2	6	2		13	3	2	5	2
	24	2	2	4	3		14	2	2	4	3
	25	3	1	4	3		15	2	1	3	3
9.	13	3	2	5	3	**9.**	23	3	2	5	3
	14	2	2	4	3		24	2	2	4	2
10.	21	3	2	5	3	**10.**	11	3	2	5	3
	22	2	2	4	3		12	3	2	5	2
	23	4	1	5	2		13	3	2	5	2

Group I CAF+B						Group II CAF+PRF membrane+B					
Sr. No.	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**	**Sr. No.**	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**
	24	3	2	5	2		14	3	2	5	2
	25	2	2	4	3		15	2	2	4	3
	11	3	1	4	3		21	3	1	4	3
	12	3	2	5	3		22	3	2	5	3
11.	13	4	1	5	2	**11.**	23	4	1	5	2
	14	2	2	4	3		24	2	2	4	3
	15	2	2	4	2		25	2	2	4	2
	12	4	2	6	3		23	4	2	6	3
12.	13	3	2	5	2	**12.**	24	3	2	5	2
	14	3	2	5	2		25	3	1	4	2
	12	2	2	4	3		21	2	2	4	3
	13	3	1	4	2		22	3	1	4	2
13.	14	3	2	5	2	**13.**	23	3	2	5	2
	15	3	2	5	2		24	4	1	5	2
	21	3	2	5	3		11	4	1	5	3
14.	22	2	2	4	3	**14.**	12	3	1	4	3
	23	3	2	5	2		13	4	2	6	2
	21	2	2	4	3		11	2	2	4	3
	22	2	2	4	3		12	2	2	4	3
15.	23	3	2	5	2	**15.**	13	3	2	5	2
	24	2	2	4	2		14	2	2	4	2
	25	2	2	4	2		15	2	2	4	2
	23	3	2	5	2		13	5	1	6	2
16.	24	3	1	4	2	**16.**	14	4	2	6	2
	25	3	2	5	2		15	3	2	4	2
	11	5	1	6	2		21	4	1	5	2
	12	3	1	4	3		22	4	1	5	3
17.	13	4	1	5	2	**17.**	23	5	1	6	2
	14	2	2	5	3		24	3	1	4	2
	15	3	2	4	2		25	3	1	4	2
18.	23	5	1	6	3	**18.**	13	4	2	6	2
	24	3	2	5	3		14	2	2	4	3
	12	2	2	4	3		22	3	2	5	3
19.	13	5	1	6	2	**19.**	23	3	2	5	2
	14	3	2	5	2		24	3	2	5	2
	21	3	2	5	3		11	3	2	5	3
	22	3	2	5	3		12	3	2	5	3
20.	23	4	2	6	3	**20.**	13	4	2	6	2
	24	4	2	6	2		14	3	2	5	2
	25	3	2	5	2		15	3	2	5	2

CLINICAL PARAMETERS

3 MONTH

Group I CAF+B						Group II CAF+PRF membrane+B					
Sr. No.	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**	**Sr. No.**	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**
1.	11	0	2	2	4	**1.**	21	0	1	1	4
	12	0	2	2	3		22	1	1	2	3
	13	1	1	2	3		23	2	1	3	3
	14	1	1	2	2		24	0	1	1	3
	15	1	1	2	2		25	1	1	2	3
2.	23	2	1	3	3	**2.**	13	1	1	2	4
	24	1	1	2	3		14	1	1	2	3
3.	21	1	1	2	3	**3.**	11	1	1	2	4
	22	1	1	2	4		12	0	1	1	4
	23	2	2	4	3		13	2	1	3	3
	24	0	1	1	3		14	0	1	1	3
	25	0	1	1	3		15	0	1	1	3
4.	23	1	1	2	3	**4.**	13	2	1	3	3
	24	0	1	1	3		14	0	1	1	4
5.	21	1	2	3	4	**5.**	11	0	1	1	4
	22	1	2	3	3		12	0	1	1	4
	23	2	1	3	3		13	2	1	3	4
	24	1	2	3	3		14	1	1	2	4
	25	0	2	2	4		15	0	2	2	3
6.	22	1	1	2	3	**6.**	13	2	1	3	4
	23	1	1	2	3		14	1	1	2	3
	24	1	1	2	3		15	0	2	2	4
7.	21	0	2	2	3	**7.**	11	0	2	2	4
	22	0	2	2	3		12	0	1	1	4
	23	1	1	2	3		13	1	1	2	4
8.	21	1	1	2	4	**8.**	11	1	1	2	4
	22	0	2	2	4		12	0	2	2	5
	23	2	2	4	3		13	1	1	2	3
	24	0	2	2	3		14	0	2	2	3
	25	1	1	2	3		15	0	2	2	3
9.	13	1	2	3	4	**9.**	23	0	2	2	5
	14	0	2	2	4		24	0	2	2	5
10.	21	1	2	3	3	**10.**	11	1	1	2	3
	22	0	1	1	4		12	1	1	2	4
	23	2	1	3	3		13	2	1	3	3

Group I CAF+B						Group II CAF+PRF membrane+B					
Sr. No.	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**	**Sr. No.**	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**
	24	1	2	3	3		14	1	1	2	3
	25	0	2	2	3		15	0	2	2	3
	11	1	1	2	4		21	0	2	2	4
	12	1	2	3	4		22	0	2	2	4
11.	13	2	1	3	3	**11.**	23	0	2	2	3
	14	0	1	1	4		24	0	2	2	3
	15	0	2	2	3		25	0	2	2	3
	12	2	1	3	4		23	1	2	3	3
12.	13	0	2	2	3	**12.**	24	0	2	2	3
	14	0	1	1	3		25	0	2	2	3
	12	0	1	1	4		21	0	1	1	4
	13	1	1	2	3		22	1	1	2	3
13.	14	1	1	2	3	**13.**	23	1	1	2	3
	15	0	2	2	3		24	0	1	1	3
	21	2	2	4	4		11	1	2	3	3
14.	22	0	1	1	4	**14.**	12	0	2	2	3
	23	1	2	3	3		13	1	1	2	3
	21	1	1	2	4		11	0	2	2	4
	22	0	2	2	3		12	0	2	2	4
15.	23	1	2	3	4	**15.**	13	0	2	2	3
	24	0	2	2	3		14	0	1	1	3
	25	0	1	1	3		15	0	1	1	3
	23	2	1	3	3		13	2	2	4	3
16.	24	1	1	2	3	**16.**	14	1	2	3	3
	25	1	2	3	3		15	1	2	3	3
	11	0	1	1	3		21	1	1	2	3
	12	0	1	1	3		22	0	2	2	3
17.	13	2	1	3	3	**17.**	23	2	2	4	3
	14	0	2	2	2		24	0	1	1	2
	15	0	2	2	3		25	0	1	1	2
18.	23	1	1	2	3	**18.**	13	2	1	3	3
	24	1	2	3	3		14	1	1	2	3
	12	0	2	2	3		22	0	2	2	3
19.	13	0	1	1	3	**19.**	23	0	2	2	3
	14	1	2	3	3		24	1	2	3	3
	21	0	1	1	3		11	1	1	3	3
	22	0	1	1	4		12	1	1	3	4
20.	23	2	2	4	3	**20.**	13	2	2	4	3
	24	2	2	4	3		14	1	2	3	3
	25	0	1	1	3		15	1	1	2	3

CLINICAL PARAMETERS

6 MONTH

Group I CAF+B						Group II CAF+PRF membrane+B					
Sr. No.	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**	**Sr. No.**	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**
1.	11	0	2	2	4	**1.**	21	0	2	2	4
	12	0	1	1	3		22	0	2	2	4
	13	1	1	2	3		23	1	1	2	4
	14	0	1	1	3		24	0	2	2	3
	15	0	1	1	2		25	0	1	1	3
2.	23	0	1	1	3	**2.**	13	0	1	1	4
	24	0	1	1	3		14	0	1	1	4
3.	21	1	1	2	3	**3.**	11	1	1	2	3
	22	0	1	1	5		12	0	1	1	4
	23	1	2	3	4		13	1	1	2	4
	24	0	1	1	3		14	0	1	1	3
	25	0	1	1	3		15	0	1	1	3
4.	23	0	1	1	4	**4.**	13	1	1	2	4
	24	0	1	1	3		14	0	1	1	4
5.	21	0	2	2	5	**5.**	11	0	1	1	4
	22	0	1	1	3		12	0	1	1	4
	23	1	1	2	3		13	1	1	2	5
	24	0	2	2	4		14	0	1	1	4
	25	0	2	2	4		15	0	1	1	4
6.	22	0	1	1	4	**6.**	13	0	1	2	4
	23	0	1	1	3		14	0	1	1	4
	24	0	1	1	3		15	0	2	2	4
7.	21	0	1	1	3	**7.**	11	0	2	2	4
	22	0	2	2	3		12	0	2	2	4
	23	0	1	1	4		13	0	2	2	4
8.	21	0	1	1	5	**8.**	11	0	1	1	4
	22	0	2	2	4		12	0	1	1	5
	23	0	2	2	4		13	0	1	1	4
	24	0	2	2	3		14	0	1	1	3
	25	0	1	1	3		15	0	1	1	3
9.	13	0	1	1	4	**9.**	23	0	2	2	5
	14	0	2	2	4		24	0	2	2	5
10.	21	1	2	3	4	**10.**	11	0	1	1	4
	22	0	1	1	4		12	0	1	1	4
	23	1	1	2	4		13	1	1	2	4

Group I CAF+B						Group II CAF+PRF membrane+B					
Sr. No.	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**	**Sr. No.**	**Tooth No. (75)**	**GRD (mm)**	**PD (mm)**	**CAL (mm)**	**KTW (mm)**
	24	0	2	2	3		14	1	1	2	3
	25	0	2	2	3		15	0	1	1	3
11.	11	0	1	1	4	**11.**	21	0	2	2	4
	12	0	1	1	4		22	0	2	2	4
	13	0	1	1	4		23	0	2	2	3
	14	0	1	1	4		24	0	2	2	3
	15	0	2	2	3		25	0	2	2	3
12.	12	1	1	2	4	**12.**	23	1	1	2	4
	13	0	2	2	3		24	0	1	1	3
	14	0	1	1	3		25	0	1	1	3
13.	12	0	1	1	4	**13.**	21	0	1	1	4
	13	1	1	2	3		22	0	1	1	4
	14	0	1	1	3		23	0	1	1	3
	15	0	2	2	3		24	0	1	1	3
14.	21	1	2	3	5	**14.**	11	0	2	2	4
	22	0	1	1	4		12	0	2	2	3
	23	0	2	2	3		13	0	1	1	4
15.	21	1	1	2	4	**15.**	11	0	1	1	4
	22	0	1	1	3		12	0	2	2	4
	23	1	2	3	4		13	0	2	2	3
	24	0	2	2	3		14	0	1	1	3
	25	0	1	1	3		15	0	1	1	3
16.	23	1	1	2	4	**16.**	13	1	2	2	4
	24	0	1	1	4		14	0	2	2	3
	25	0	2	2	3		15	0	2	2	4
17.	11	0	1	1	3	**17.**	21	1	1	1	3
	12	0	1	1	3		22	0	2	2	3
	13	1	1	2	4		23	1	2	2	4
	14	0	2	2	2		24	0	1	1	3
	15	0	1	1	3		25	0	1	1	2
18.	23	1	1	2	3	**18.**	13	1	1	2	4
	24	0	2	2	3		14	0	1	1	3
19.	12	0	2	2	3	**19.**	22	0	2	2	3
	13	0	1	1	3		23	0	2	2	3
	14	0	2	2	3		24	0	1	1	3
20.	21	0	1	1	3	**20.**	11	0	1	2	4
	22	0	1	1	4		12	0	2	2	4
	23	1	1	2	3		13	1	2	3	3
	24	1	2	3	3		14	0	2	2	3
	25	0	1	1	3		15	0	1	1	4

CBCT MEASUREMENTS

DISTANCE OF GINGIVAL MARGIN TO ALVEOLAR CREST

(GMB)

Group I CAF+B				Group II CAF+PRF membrane+B			
Sr. No.	**Tooth No.**	**Baseline (mm)**	**6 Month (mm)**	**Sr. No.**	**Tooth No.**	**Baseline (mm)**	**6 Month (mm)**
1.	11	2.1	3.5	**1.**	21	2.3	4.2
	12	2.3	3.5		22	2.4	4
	13	2.3	3.3		23	2.2	3.7
	14	1.6	3		24	2.1	3.7
	15	1.6	3		25	2.1	3.3
2.	23	3	3	**2.**	13	3.3	4.3
	24	2.5	3.1		14	2.8	3.5
3.	21	1.4	3	**3.**	11	1.1	3.3
	22	2.1	3.5		12	1.3	3.9
	23	2	3		13	2.3	4
	24	2	3		14	2	3
	25	2.1	3.6		15	2.1	3.2
4.	23	2.5	4	**4.**	13	3.9	4.8
	24	3.4	4.6		14	2.8	4.3
5.	21	2.9	4.2	**5.**	11	2.9	3.9
	22	2.7	3.8		12	2.6	3.8
	23	3.1	5		13	2.5	3.8
	24	3.1	3.4		14	2.5	4
	25	2.8	3.2		15	2.3	3.7
6.	22	2.1	4	**6.**	13	2.4	3.6
	23	1.2	4		14	2.6	3.2
	24	2	3		15	2.6	4
7.	21	2.8	3.6	**7.**	11	2.8	3.8
	22	3.2	4.4		12	1.8	3.4
	23	2.1	3.1		13	1.7	2.8
8.	21	2.9	3.8	**8.**	11	2.7	3.5
	22	2.5	3.5		12	2.5	4
	23	2.6	3.7		13	3.1	4.5
	24	2.6	3.8		14	3	4
	25	3	3.8		15	2.7	4
9.	13	3	3.6	**9.**	23	2.9	4
	14	2.8	3.5		24	2.5	4
10.	21	1.6	2.8	**10.**	11	2.6	4
	22	2.4	4		12	3.5	4
	23	2	3.3		13	1.2	3
	24	2	4		14	2.3	3
	25	2.2	4.5		15	2	3.5

Group I CAF+B				Group II CAF+PRF membrane+B			
Sr. No.	**Tooth No.**	**Baseline (mm)**	**6 Month (mm)**	**Sr. No.**	**Tooth No.**	**Baseline (mm)**	**6 Month (mm)**
11.	11	3	4	**11.**	21	3.1	4.3
	12	2.4	3.5		22	2.2	3.5
	13	3.1	4.2		23	3.1	4
	14	2.9	4		24	1.8	3.8
	15	1.8	3		25	2.6	3.9
12.	12	2.5	4	**12.**	23	2.4	4
	13	2.3	3.9		24	3.4	4
	14	2.1	4		25	2.2	4.2
13.	12	2.3	4.2	**13.**	21	2.8	4
	13	2.1	4		22	3	4.2
	14	3.1	4		23	2.3	4
	15	1.7	3.5		24	1.9	3.5
14.	21	2	3.5	**14.**	11	3.2	4
	22	2.5	3.9		12	2.9	3.9
	23	2.4	3		13	2.7	3.8
15.	21	3	3.5	**15.**	11	2.3	4.2
	22	3.3	3.5		12	2.4	4.4
	23	2.3	2.6		13	2.2	4.1
	24	1.6	2.3		14	2.1	4.2
	25	1.6	3		15	2.1	3.5
16.	23	2.1	3.2	**16.**	13	3.9	4.8
	24	1.1	2.6		14	2.8	4.3
	25	1.9	3.2		15	2.6	3.1
17.	11	1.4	3		21	1.1	2.1
	12	2.1	3.2	**17.**	22	1.3	2.7
	13	2.5	3.5		23	2.3	3.2
	14	2.6	3.6		24	2	3.5
	15	2.4	3.5		25	2.1	3.3
18.	23	2	4	**18.**	13	3.3	4.3
	24	2.5	3.3		14	2.8	4
19.	12	2.8	3.6	**19.**	22	2.4	3.6
	13	3.2	4.4		23	2.6	3.8
	14	2.1	3.1		24	2.6	3.8
20.	21	3	4	**20.**	11	2.9	3.9
	22	3.3	4.3		12	2.6	3.4
	23	2.3	4		13	2.5	3.8
	24	1.6	4		14	2.5	4
	25	1.6	3.5		15	2.3	3.4

CBCT MEASUREMENTS

GINGIVAL THICKNESS

BASELINE

Group I CAF+B					Group II CAF+PRF membrane+B				
Sr. No.	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**	**Sr. No.**	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**
1.	11	0.9	0.8	0.8	**1.**	21	1.1	0.7	0.5
	12	1.3	2.2	1.4		22	1.8	1.1	1
	13	0.7	0.7	0.7		23	0.8	0.9	0.7
	14	1.3	1.5	1.1		24	1.5	1.1	0.7
	15	1.1	1.5	1.2		25	1.5	1	0.6
2.	23	1.3	1.3	1.3	**2.**	13	1.3	1.3	1.3
	24	1.1	1.5	1.5		14	1.1	1.5	1.5
3.	21	1.1	1.2	0.8	**3.**	11	1.1	0.6	1
	22	0.9	1.4	0.8		12	0.8	1.1	1
	23	0.8	0.7	1.1		13	0.8	1.4	0.8
	24	1.1	1.5	1.1		14	1	1.4	0.7
	25	0.5	1.5	0.8		15	1.1	1.4	0.7
4.	23	1.1	1.2	1.2	**4.**	13	1.3	1.1	1.1
	24	1.7	2	1.4		14	1.1	1.3	1.2
5.	21	2.3	1.9	1	**5.**	11	1.6	1.8	1.7
	22	3.1	2.3	1.8		12	1	1.9	1.9
	23	1.1	1.4	1		13	1	1.3	1.4
	24	1.3	2.1	1.6		14	1	1.8	1.3
	25	0.4	1.4	1		15	1	1.3	1.3
6.	22	1.4	1	1	**6.**	13	0.7	0.6	0.6
	23	0.6	1.1	0.9		14	0.4	1	0.9
	24	0.6	1.1	0.9		15	0.7	1.7	1.8
7.	21	1.1	1.5	0.9	**7.**	11	0.9	1.1	0.8
	22	1	1.8	1		12	1	1.2	1
	23	0.5	1.2	0.7		13	0.9	1	0.9
8.	21	1	1.6	1	**8.**	11	1.6	1.6	1.1
	22	1.1	1.2	1.1		12	1.2	1.1	1.1
	23	1.3	1	0.9		13	1.3	1.3	1.1
	24	1.2	1.3	1.1		14	1.2	1.2	1.3
	25	1.5	1.4	1.2		15	1.3	1.3	1.5
9.	13	0.3	0.9	1	**9.**	23	1	1	1.5
	14	1.2	0.9	1		24	1	1.2	1.1
10.	21	1	1.1	0.8	**10.**	11	1.4	1.1	0.7
	22	1.3	1.5	0.6		12	1.5	1.1	1.1
	23	2	1.8	1		13	1.1	0.7	0.7
	24	1.9	1.4	0.9		14	1.3	1.6	1.4

Group I CAF+B					Group II CAF+PRF membrane+B				
Sr. No.	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**	**Sr. No.**	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**
	25	3.1	2.8	1.6		15	1.4	1.5	1.5
	11	1.3	1.4	0.9		21	1.3	1.1	1.8
	12	0.9	1.5	0.8		22	0.8	1.7	1.2
11.	13	0.9	1.4	0.9	**11.**	23	0.6	1.3	1
	14	0.7	1.4	1.3		24	0.6	1.8	1.1
	15	0.8	1.8	1.5		25	1.1	2.1	1.2
	12	1.6	2	1.7		23	0.6	1.2	0.9
12.	13	0.9	1	0.6	**12.**	24	1.1	1.5	1.2
	14	1.5	1.9	1.7		25	1.3	1.9	1.7
	12	0.8	1.7	1.4		21	1.4	1.7	0.9
13.	13	1.1	1.3	0.7	**13.**	22	0.7	1.7	1.1
	14	1.1	2.5	2.3		23	0.7	1.7	1.1
	15	0.7	1.7	1.7		24	0.4	0.8	0.7
	21	1	1.5	0.9		11	1	1.4	1
14.	22	1.1	1.5	0.9	**14.**	12	1	1.7	1.2
	23	0.8	1.4	0.9		13	0.8	1.5	1.1
	21	0.9	0.8	0.8		11	1.1	0.7	0.5
	22	1.3	2.2	1.4		12	1.8	1.1	1
15.	23	0.7	0.7	0.7	**15.**	13	0.8	0.9	0.7
	24	1.3	1.5	1.1		14	1.5	1.1	0.7
	25	1.1	1.5	1.2		15	1.5	1	0.6
	23	1.1	1.3	0.7		13	1.3	1.1	1.1
16.	24	1.1	2.5	2.3	**16.**	14	1.1	1.3	1.2
	25	0.7	1.7	1.7		15	0.7	1.6	1.1
	11	1.1	1.2	0.8		21	1.1	0.6	1
	12	0.9	1.4	0.8		22	0.8	1.1	1
17.	13	0.8	0.7	1.1	**17.**	23	0.8	1.4	0.8
	14	1.1	1.5	1.1		24	1	1.4	0.7
	15	0.5	1.5	0.8		25	1.1	1.4	0.7
18.	23	1.1	1.2	1.2	**18.**	13	1.3	1.3	1.3
	24	1.7	2	1.4		14	1.1	1.5	1.5
	12	1.4	1	1		22	0.7	0.6	0.6
19.	13	0.6	1.1	0.9	**19.**	23	0.4	1	0.9
	14	0.6	1.1	0.9		24	0.7	1.7	1.8
	21	2.3	1.9	1		11	1.6	1.8	1.7
	22	3.1	2.3	1.8		12	1	1.9	1.9
20.	23	1.1	1.4	1	**20.**	13	1	1.3	1.4
	24	1.3	2.1	1.6		14	1	1.8	1.3
	25	0.4	1.4	1		15	1	1.3	1.3

CBCT MEASUREMENTS

GINGIVAL THICKNESS

6 MONTH

Group I CAF+B					Group II CAF+PRF membrane+B				
Sr. No.	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**	**Sr. No.**	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**
1.	11	2.5	2.2	1.8	**1.**	21	2.3	1.8	1.5
	12	2.8	2.7	1.9		22	2.3	2.4	2.1
	13	2	1.6	1.2		23	1.5	1.2	0.8
	14	1.3	1.9	1.5		24	2.4	2.8	2.3
	15	1.2	2	1.5		25	1.5	1.1	1.5
2.	23	1.5	1.5	1.7	**2.**	13	2.3	2	2
	24	1.3	2	2		14	3	2.3	2.3
3.	21	1.4	1.5	1.5	**3.**	11	3	1.5	3
	22	1.5	1.8	1.5		12	2.5	2.5	3
	23	1.5	1.5	1.6		13	2.5	2.5	1.9
	24	1.7	1.8	1.6		14	3	2.7	2
	25	1	1.8	1.5		15	3	2.6	2
4.	23	1.8	2	1.7	**4.**	13	1.9	2.6	2.5
	24	1.8	2.5	2.8		14	1.2	1.4	1.4
5.	21	2.3	2.5	2.3	**5.**	11	1.9	2	1.9
	22	3.4	2.7	1.9		12	1.9	2.5	2.2
	23	1.8	2	1.2		13	2.3	2	1.6
	24	1.7	2.3	2		14	1.1	2	1.4
	25	1.4	2.3	1.4		15	2.8	2.4	2
6.	22	2	1.8	1	**6.**	13	1.4	1.9	1.6
	23	1.4	1.5	1.5		14	1.4	1.8	1.7
	24	1.4	1.9	1.6		15	1.4	2.5	2
7.	21	1.4	2.3	1.7	**7.**	11	1.9	2.9	1.9
	22	2.1	2.8	2.4		12	2.2	2.1	1.7
	23	1.6	2	1.1		13	2	1.8	1.3
8.	21	1.5	2	1.5	**8.**	11	2.6	3	2
	22	1.7	2	1.8		12	2.8	2.9	2
	23	2	1.8	1.8		13	2.9	2.5	2.4
	24	1.7	1.9	1.6		14	3	2.6	2.6
	25	1.7	1.9	1.8		15	3	3	2.6
9.	13	1.5	1.5	2	**9.**	23	3	3	3
	14	1.9	2	2		24	3	3	3.9
10.	21	1.7	1.6	1.4	**10.**	11	3	3.2	2.9
	22	2	1.9	1.2		12	3	3.1	3
	23	2.3	2.1	1.5		13	2.5	2.2	1.9
	24	2.5	1.8	1.6		14	2.8	2.5	2.5

Group I CAF+B					Group II CAF+PRF membrane+B				
Sr. No.	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**	**Sr. No.**	**Tooth No. (75)**	**GT1 (mm)**	**GT2 (mm)**	**GT3 (mm)**
	25	3.4	3	2		15	2.5	2.9	2.9
11.	11	2	1.9	2	**11.**	21	2.3	3	3.2
	12	2.1	2	2.1		22	2.6	3	3
	13	1.8	2	2		23	3	3	3
	14	1.8	2	2.1		24	3	3	2.4
	15	1.5	2	2		25	2.9	3.5	3.5
12.	12	2	2.5	2.1	**12.**	23	1.5	3.2	1.8
	13	2.1	2	1.6		24	1.9	3.5	2.8
	14	2	2.5	2		25	2	3.9	2.9
13.	12	1.7	2	2	**13.**	21	3	3	3
	13	2	1.7	1.2		22	2.5	3	3
	14	2	2.7	2.7		23	2.5	3	3
	15	1.5	2	2		24	2.3	3	3
14.	21	1.6	1.9	1.4	**14.**	11	3	3.3	3.3
	22	1.8	1.9	1.5		12	3	3.2	3.2
	23	1.5	1.9	1.9		13	2.9	3.2	3.2
15.	21	2.5	2.2	1.8	**15.**	11	2.3	1.8	1.5
	22	2.8	2.7	1.9		12	2.3	2.4	2.1
	23	2.1	1.6	1.2		13	1.5	1.2	0.8
	24	3.6	1.9	1.5		14	2.4	2.8	2.3
	25	1.2	2	1.5		15	1.5	1.1	1.5
16.	23	2	1.7	1.2	**16.**	13	1.9	2.6	2.5
	24	2	2.7	2.7		14	1.2	1.4	1.4
	25	1.5	2	2		15	1.3	1.8	1.5
17.	11	1.4	1.5	1.5	**17.**	21	3	1.5	3
	12	1.5	1.8	1.5		22	2.5	2.5	3
	13	1.5	1.5	1.6		23	2.5	2.5	1.9
	14	1.7	1.8	1.6		24	3	2.7	2
	15	1	1.8	1.5		25	3	2.6	2
18.	23	1.8	2	1.7	**18.**	13	2.3	2	2
	24	1.8	2.5	2.8		14	3	2.3	2.3
19.	12	2	1.8	1	**19.**	22	1.4	1.9	1.6
	13	1.4	1.5	1.5		23	1.4	1.8	1.7
	14	1.4	1.9	1.6		24	1.4	2.5	2
20.	21	2.3	2.5	2.3	**20.**	11	1.9	2	1.9
	22	3.4	2.7	1.9		12	1.9	2.5	2.2
	23	1.8	2	1.2		13	2.3	2	1.6
	24	1.7	2.3	2		14	1.1	2	1.4
	25	1.4	2.3	1.4		15	2.8	2.4	2

ROOT COVERAGE AESTHETIC SCORE (RES)

Group I CAF+B			Group II CAF+PRF membrane+B		
Sr. No.	**Tooth No. (75)**	**RES**	**Sr. No.**	**Tooth No. (75)**	**RES**
1.	11	8	**1.**	21	10
	12	10		22	10
	13	8		23	6
	14	5		24	10
	15	10		25	10
2.	23	9	**2.**	13	8
	24	8		14	8
3.	21	7	**3.**	11	5
	22	8		12	10
	23	6		13	7
	24	8		14	10
	25	10		15	8
4.	23	10	**4.**	13	6
	24	10		14	9
5.	21	8	**5.**	11	9
	22	9		12	9
	23	5		13	7
	24	8		14	10
	25	9		15	8
6.	22	10	**6.**	13	9
	23	10		14	9
	24	9		15	9
7.	21	10	**7.**	11	10
	22	10		12	10
	23	10		13	9
8.	21	9	**8.**	11	9
	22	9		12	10
	23	9		13	10
	24	9		14	10
	25	9		15	9
9.	13	9	**9.**	23	9
	14	9		24	9
10.	21	8	**10.**	11	8
	22	9		12	8
	23	6		13	5
	24	10		14	5
	25	10		15	10

Group I CAF+B			Group II CAF+PRF membrane+B		
Sr. No.	**Tooth No. (75)**	**RES**	**Sr. No.**	**Tooth No. (75)**	**RES**
11.	11	10	**11.**	21	10
	12	10		22	10
	13	10		23	10
	14	10		24	10
	15	10		25	10
12.	12	7	**12.**	23	7
	13	10		24	10
	14	9		25	9
13.	12	10	**13.**	21	10
	13	7		22	10
	14	10		23	10
	15	8		24	8
14.	21	7	**14.**	11	9
	22	8		12	10
	23	8		13	10
15.	21	7	**15.**	11	10
	22	10		12	9
	23	6		13	9
	24	10		14	9
	25	10		15	10
16.	23	5	**16.**	13	7
	24	9		14	8
	25	9		15	9
17.	11	8	**17.**	21	5
	12	10		22	10
	13	6		23	7
	14	10		24	9
	15	10		25	10
18.	23	6	**18.**	13	7
	24	9		14	10
19.	12	8	**19.**	22	10
	13	10		23	10
	14	10		24	10
20.	21	10	**20.**	11	9
	22	10		12	9
	23	7		13	7
	24	7		14	9
	25	10		15	9

VISUAL ANALOG SCALE (VAS)

Sr. No.	Group I CAF+B		Group II CAF+PRF membrane+B	
	VAS-P	VAS-E	VAS-P	VAS-E
1.	100	100	100	100
2.	50	50	50	50
3.	100	100	100	100
4.	100	50	100	50
5.	50	50	50	50
6.	50	50	50	50
7.	50	50	50	50
8.	0	100	0	100
9.	100	100	100	100
10.	50	100	50	100
11.	50	100	50	100
12.	100	50	100	100
13.	50	50	50	50
14.	100	50	100	50
15.	50	100	50	100
16.	50	50	50	50
17.	100	100	100	100
18.	50	100	50	100
19.	100	50	50	50
20.	100	50	50	50

Comparative Evaluation of Coronally Advanced Flap with Orthodontic Button Application with and without Platelet Rich Fibrin Membrane in Treatment of Multiple Gingival Recession Defects:

A Clinicoradiographic Study

MAIN DISSERTATION-CASE HISTORY

NAME- **OPD NO-**

AGE/SEX- **DATE-**

OCCUPATION- **ADDRESS-**

CHIEF COMPLAINT :

HISTORY OF PRESENT ILLNESS :

PAST DENTAL HISTORY :

PAST MEDICAL HISTORY:

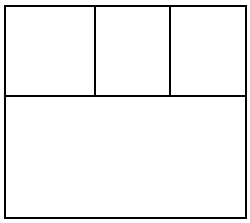
PERSONAL HISTORY

1) ADVERSE HABITS:

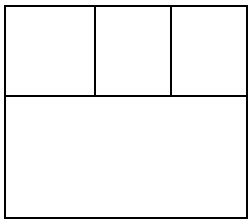
2) ORAL HYGIENE HABITS:

INDICES

1. PLAQUE INDEX (PI) (BASELINE)



16



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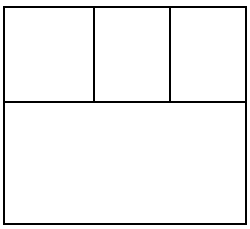

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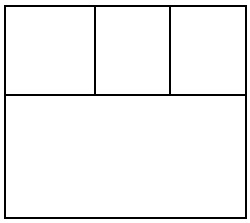

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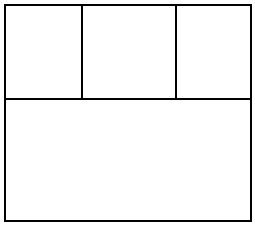

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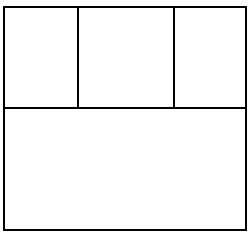
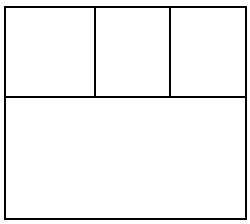


36

Score

PLAQUE INDEX (PI) (3-MONTH)



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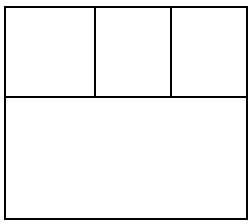

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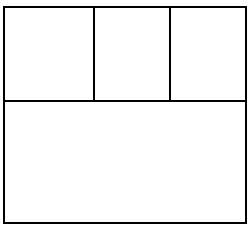

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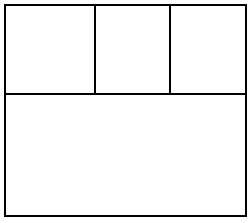

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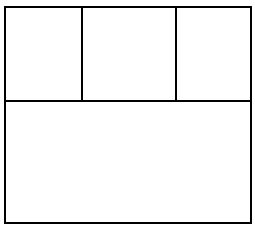

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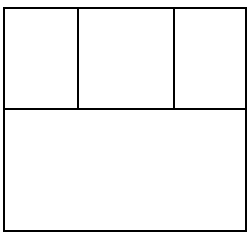

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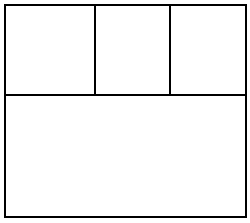
Score

PLAQUE INDEX (PI) (6-MONTH)



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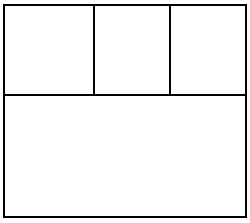

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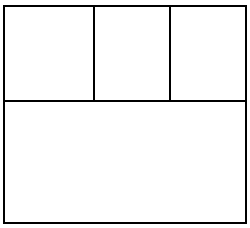

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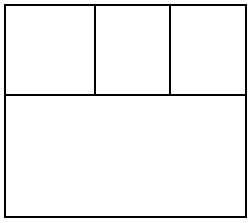

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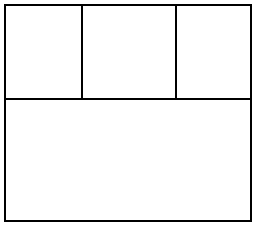

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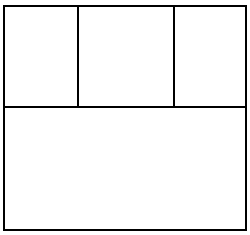
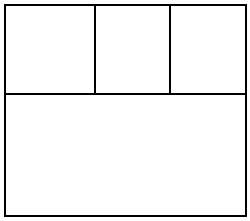


36

Score

2. GINGIVAL INDEX (GI) (BASELINE)



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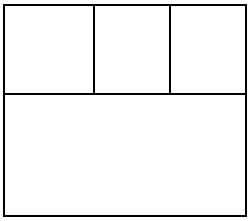

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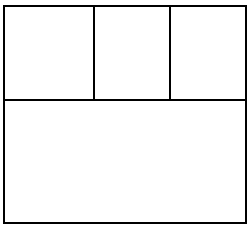

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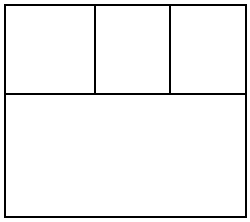

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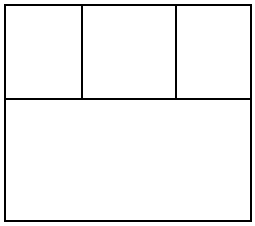

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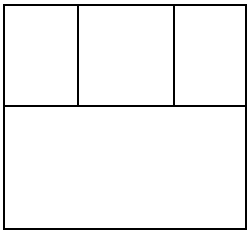
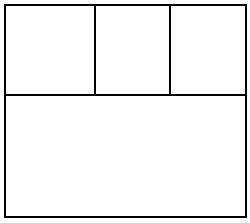


36

Score

GINGIVAL INDEX (GI) (3-MONTH)



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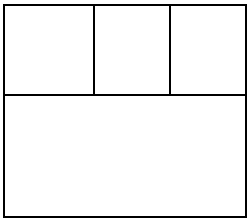

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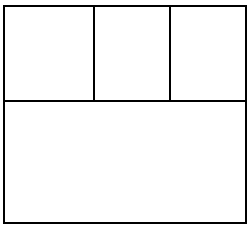

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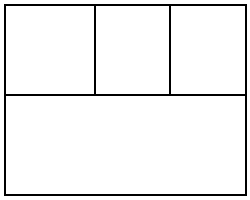

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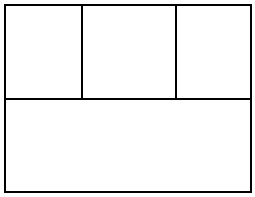

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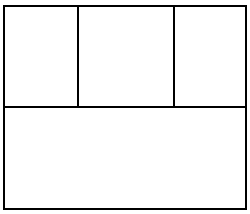

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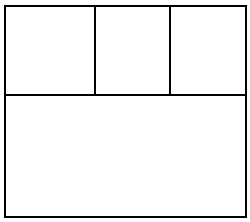
Score

GINGIVAL INDEX (GI) (6-MONTH)



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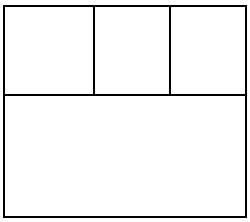

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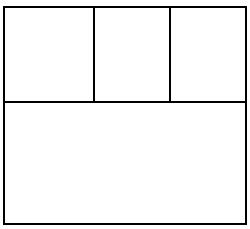

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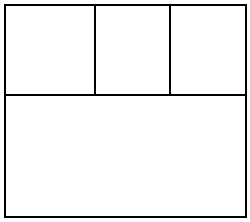

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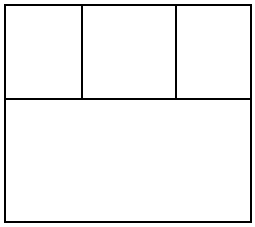

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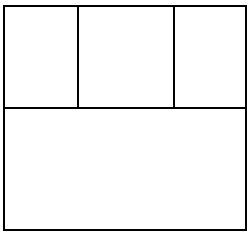
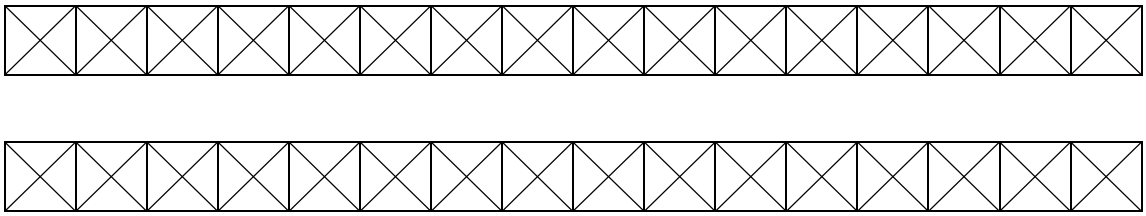


36

Score

PROBING DEPTH (mm) (BASELINE)

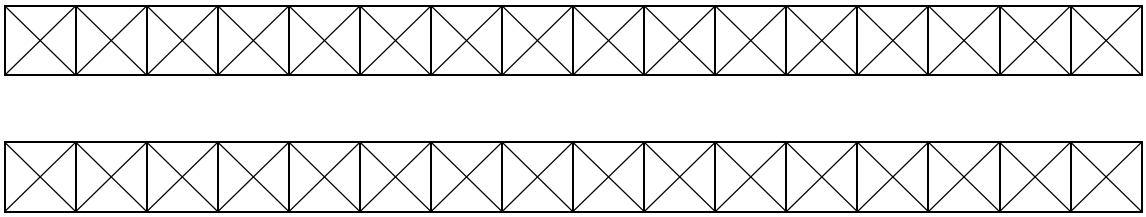
18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28



48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

PROBING DEPTH (mm) (3-MONTH)

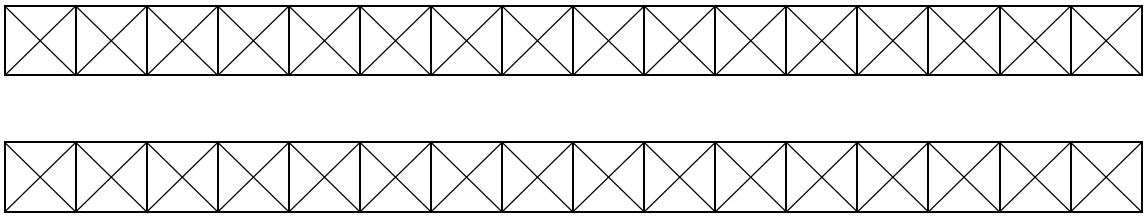
18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28



48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

PROBING DEPTH (mm) (6-MONTH)

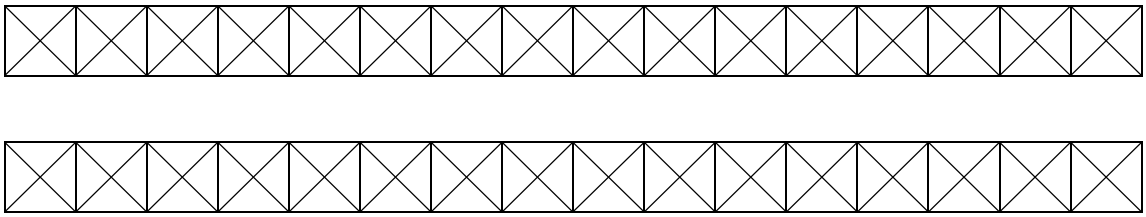
18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28



48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

CLINICAL ATTACHMENT LEVEL (mm) (BASELINE)

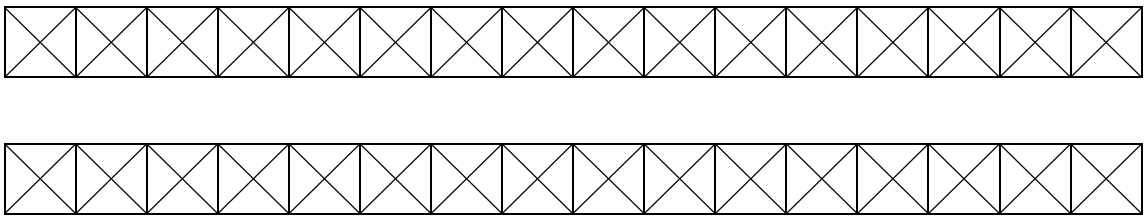
18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28



48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

CLINICAL ATTACHMENT LEVEL (mm) (3- MONTH)

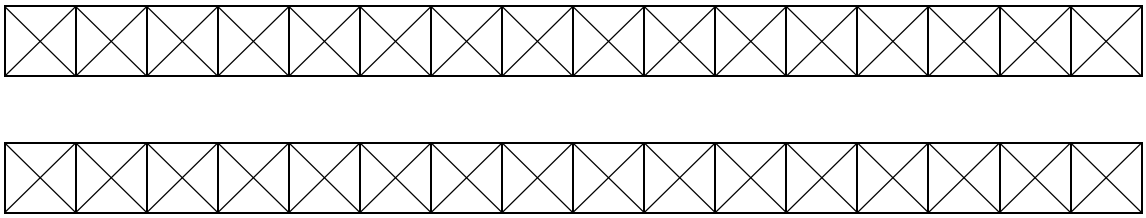
18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28



48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

CLINICAL ATTACHMENT LEVEL (mm) (6-MONTH)

18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28



48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38

A) <u>CONTROL SITE</u>

1) DISTANCE BETWEEN INCISAL EDGE TO CEJ (mm)

Tooth no.	Distance in mm

2) GINGIVAL RECESSION DEPTH (GRD) (mm)

Tooth no.	Baseline	3 months	6 months

3) APICO-CORONAL WIDTH OF KERATINIZED TISSUE (KTW) (mm)

Tooth no.	Baseline	3 months	6 months

4) GINGIVAL MARGIN - BONE (CBCT) (mm)

Tooth no.	GMB (BASELINE)	GMB (6-MONTH)

5) GINGIVAL THICKNESS (CBCT) (mm)

Tooth no.	GT1-B	GT1-6	GT2-B	GT2-6	GT3-B	GT3-6

6) ROOT COVERAGE AESTHETIC SCORE SYSTEM

Tooth no.	Gingival Margin (GM)	Marginal Tissue Contour (MTC)	Soft tissue texture (STT)	Mucogingival junction alignment (MGJ)	Gingival colour (GC)

B) TEST SITE

1) DISTANCE BETWEEN INCISAL EDGE TO CEJ (mm)

Tooth no.	Distance in mm

2) GINGIVAL RECESSION DEPTH (GRD) (mm)

Tooth no.	Baseline	3 months	6 months

3) APICO-CORONAL WIDTH OF KERATINIZED TISSUE (KTW) (mm)

Tooth no.	Baseline	3 months	6 months

4) GINGIVAL MARGIN - BONE (CBCT) (mm)

Tooth no.	GMB (BASELINE)	GMB (6-MONTH)

5) GINGIVAL THICKNESS (CBCT) (mm)

Tooth no.	GT1-B	GT1-6	GT2-B	GT2-6	GT3-B	GT3-6

6) ROOT COVERAGE AESTHETIC SCORE SYSTEM

Tooth no.	Gingival Margin(GM)	Marginal Tissue Contour(MTC)	Soft tissue texture(STT)	Mucogingival junction alignment(MGJ)	Gingival colour(GC)

C) POST-OPERATIVE DISCOMFORT AND AESTHETICS SCORE

	VAS-P	VAS-E
Control Group		
Test Group		

(Confidential)
INFORMED CONSENT FORM

Comparative Evaluation of Coronally Advanced Flap with Orthodontic Button Application with and without Platelet Rich Fibrin Membrane in Treatment of Multiple Gingival Recession Defects: A Clinicoradiographic Study

Mr./Master/Mrs./Miss._____

Resident of: _____

_____aged _____ years,

Exercising my free will/choice, without any pressure/lure of incentive in any form, hereby give my consent for the project.

I acknowledge the receipt of "patient's information sheet", and also the doctor has informed me about this research project suitably and sufficiently to my satisfaction. I agree to let my photographs, impressions, other investigations to be taken as required. I agree to take part in this project and will not mix any other projects during the period of this trial. I shall report to the dental hospital or other place where called on given appointment dates and time. I shall inform the doctor on any adverse effects or unusual symptoms noticed by me. I shall co-operate with the doctors and paramedical staff, in all respects. I permit to publishing the results of my participation in this study. I shall not be given any reimbursement or compensation. I have been informed of my right to opt out of this research project at any time without giving any reason for doing so. I hereby record my consent for participation in the said trial.

_____	_____	_____	_____
Patient's name	Signature/thumbprint	Date	Time
_____	_____	_____	_____
Investigator's name	Signature	Date	Time