Clinical evaluation of expanded mesh connective tissue graft in the treatment for multiple adjacent gingival recessions in the esthetic zone

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Abstract

Background: Multiple approaches have been used to replace lost, damaged or diseased gingival tissues. The connective tissue graft (CTG) procedure is the golden standard method for root coverage. Although multiple sites often need grafting, the palatal mucosa supplies only a limited area of grafting material. To overcome this limitation, expanded mesh graft provides a method whereby a graft can be stretched to cover a large area. The aim of this study was to evaluate the effectiveness and the predictability of expanded mesh CTG (e-MCTG) in the treatment of adjacent multiple gingival recessions. **Materials and Methods:** Sixteen patients aged 20–50 years contributed to 55 sites, each site falling into at least three adjacent Miller's Class 1 or Class 2 gingival recession. The CTG obtained from the palatal mucosa was expanded to cover the recipient bed, which was 1.5 times larger than the graft. Clinical measurements were recorded at baseline and 3 months, 12 months postoperatively. **Results:** A mean coverage of 1.96 mm ± 0.66 mm and 2.22 mm ± 0.68 mm was obtained at the end of 3rd and 12th month, respectively. Twelve months after surgery a statistically significant increase in CAL (2.2 mm ± 0.68 mm, $P < 0.001$) and increasing WKT (1.75 ± 0.78, $P < 0.001$) were obtained. In 80% of the treated sites, 100% root coverage was achieved (mean 93.5%). **Conclusions:** The results of this study demonstrated that multiple adjacent recessions were treated by using e-MCTG technique can be applied and highly predictable root coverage can be achieved.

Keywords: Expanded mesh connective tissue graft, gingival recession, root coverage, subepithelial connective tissue graft

Introduction

Gingival recession is defined as the partial denudation of the root surface due to the apical migration of the gingival margin.[1] Etiological factors include trauma from tooth brushing, malposition of teeth, ectopic insertion of frenum, and muscle attachments. The major therapeutic goals in mucogingival surgery are a correction of esthetic problems and management of hypersensitivity. Numerous surgical procedures have been described to achieve soft tissue coverage of exposed root surfaces including coronally repositioned flaps, pedicle grafts, free gingival grafts, subepithelial connective tissue grafts (CTG), and guided tissue generation (GTR) were commonly used procedures.[2-10]

The treatment of isolated or multiple buccal recessions with different surgical procedures depends on many factors such as defect size, presence or absence of keratinized tissue adjacent to the defect, and thickness of the gingiva. Since the patients are concerned about their esthetic appearance, every effort should be made to achieve complete root coverage up to the cementoenamel junction (CEJ).[4,11,12]

Originally Sullivan and Atkins[13] described a technique for coverage of exposed root surfaces using the free gingival autogenous graft. The graft survival over large expanses of avascular root surfaces was unpredictable, and complete root coverage was rarely achieved.

Karring *et al*.[14] demonstrates that the underlying connective tissue has a direct bearing on the type of epithelium that is superimposed upon it. Edel[15] showed that a significant increase in the volume of gingiva can be achieved by grafting gingival connective tissue alone.

Langer and Langer[16] described the CTG technique in root coverage on both single and multiple adjacent teeth. The advantage is the dual blood supply from the overlying flap and palatal connective tissue, which maximizes graft survival. It also provides excellent esthetic results.

When multiple adjacent teeth with gingival recessions are present in esthetic regions of the mouth, the preferred

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surgical technique should be such the one, which provides the possibility of achieving maximum root coverage.[9,13]

One of the problems with multiple root coverage grafting is the unavailability of the large blood supply of donor tissue. If connective tissue supply is limited, more than one surgical procedure may be needed.[11,12] The purpose of the present study was to evaluate the effectiveness and the predictability of expanded mesh CTG (e-MCTG) procedure for the treatment of multiple adjacent gingival recession defects.

Materials and Methods

The study population 16 patients, (age range 20–55 years mean age 37 years) with either dentin hypersensitivity or esthetic problems caused due to the recession defects were included in the study. A total of 55 sites were treated in 16 patients.

Prior to initiation of the study, ethical approval was obtained from institution ethical committee. All the patients agreed to the study protocol, and signed informed consent was obtained prior to inclusion in the study. The inclusion criteria are (1) the presence of at least three adjacent Miller's Class I or Class II gingival recession[17] on the buccal/facial aspect with recession depth (RD) of ≥2 mm, (2) probing depth (PD) of ≤3 mm, (3) a minimum width of keratinized gingival (KG) of at least 1 mm. Nine subjects contributes three sites, and seven subjects contributed four sites [Figure 1].

The exclusion criteria are (1) the presence of severe cervical abrasion/root caries, (2) the presence of abnormal frenal attachment, (3) Current smokers, (4) Medically compromised patients, (5) Miller's Class III and IV gingival recession.[17]

The patients initially completed a plaque control program, so as to achieve a full mouth plaque score (FMPS) <25%.

Clinical measurements

The following clinical measurements were taken by a single examiner at baseline and 3 months, 12 months postoperatively. (1) RD measured from the Cemento-Enamel Junction (CEJ) to the gingival margin, (2) recession width (RW) measured across the buccal surface at the CEJ level, (3) PD measured from the gingival margin to the bottom of the gingival sulcus, (4) width of keratinized tissue (KT) measured from the gingival margin into the mucogingival junction, (5) clinical attachment level (CAL) measured from CEJ to the bottom of the gingival sulcus. All measurements were performed at the mid buccal level using a William's periodontal probe (Hu-Friedy) and rounded to the nearest 0.5 mm.

Surgical procedure

All surgical procedures were done by the same operator. Following the induction of local anesthesia (Lignocaine hydrochloride with 1:100,000 adrenaline), an intra-crevicular incision was made through the bottom of the crevice and horizontal incision was placed at the level of CEJ extending 3 mm on either side of the involved tooth including their papilla. Two vertical incisions were placed from the end point of the horizontal incision to the alveolar mucosa to establish a trapezoidal flap [Figure 2].

A full thickness flap was elevated to 3–4 mm apical to the bone dehiscence followed by a split thickness flap and all muscle interferences were eliminated in order to facilitate its coronal advancement. The remaining buccal soft tissue of the anatomic interdental papillae was de-epithelized. The root surface was mechanically instrumented using Gracey curettes followed by conditioning with 1 ml tetracycline hydrochloride solution for 3 min with subsequent rinsing with saline [Figure 3].

CTG was harvested from the molar- premolar area of the palate on one side [Figures 4 and 5]. The donor site was then sutured with 4-0 black silk to ensure primary intention healing. Alternating incisions were then made on each edge of the harvested graft to expand it [Figure 6] so that it would cover the recipient bed completely, which was 1.5 times larger than the graft [Figure 7]. Subsequently, the graft was positioned at the CEJ with interrupted 5-0 vicryl bioabsorbable sutures [Figure 8]. The mucogingival flap was coronally repositioned without tension to cover the e-MCTG with 4-0 silk sutures [Figure 9]. The area was re-examined to ascertain that the graft was completely covered by the flap. A periodontal dressing (coe-pak) was placed over the recipient site and removed after a week.

All patients were instructed to discontinue tooth brushing in the surgical site for 1-week so as to avoid trauma or pressure at the surgical site. A 0.12% chlorhexidine digluconate mouth rinse was prescribed 2 times daily for 15 days. Analgesics (Ibu Profen and paracetamol tds for 5 days) and antibiotics (amoxycillin 500 mg tds for 5 days) were prescribed. Mechanical tooth cleaning of the treated areas using a soft toothbrush and a careful roll technique was resumed following the removal of periodontal dressing.

The patients were recalled for oral prophylaxis after 2, 4 weeks, and every 3 months for 1-year. The postoperative clinical measurements were taken at the end of 3rd and 12th month [Figures 10 and 11].

The data were collected, and statistical analysis was performed using Statistical Package for Social Science version 16 (SPSS, IBM Corp., Chicago, USA).

Results

At baseline, mean RD was 2.56 mm ± 0.62 mm, mean RW was 3.44 mm ± 0.44 mm, mean KT was 2.13 mm ± 0.73 mm, mean PD was 1.15 mm ± 0.23 mm, and a mean CAL was

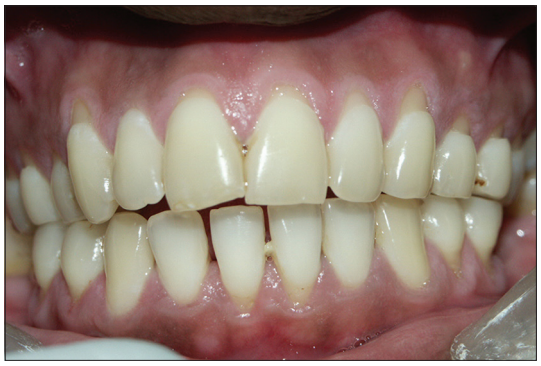

Figure 1: Preoperative facial view of gingival recession

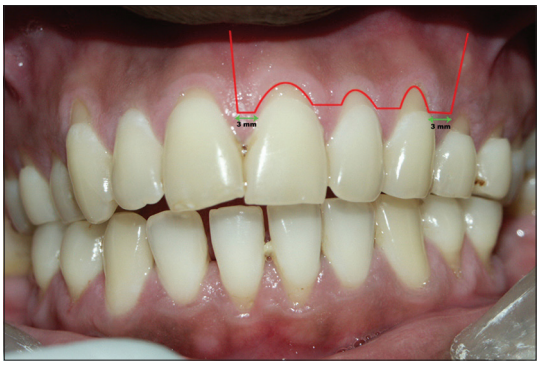

Figure 2: Line diagram depicting the incisions

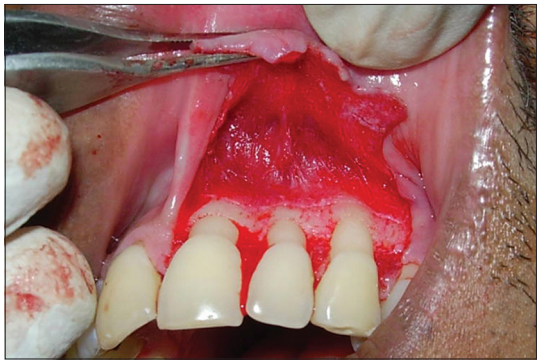

Figure 3: Split thickness trapezoidal flap was elevated

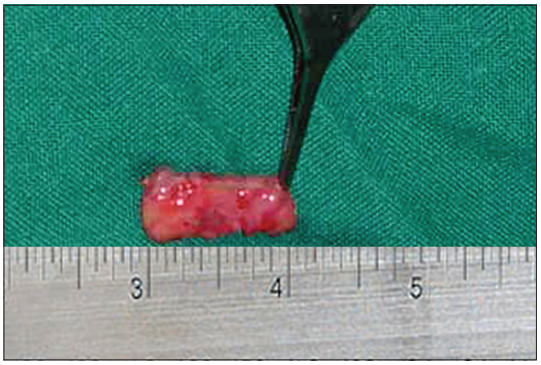

Figure 4: Original size of the connective tissue graft was harvested from palatal mucosa

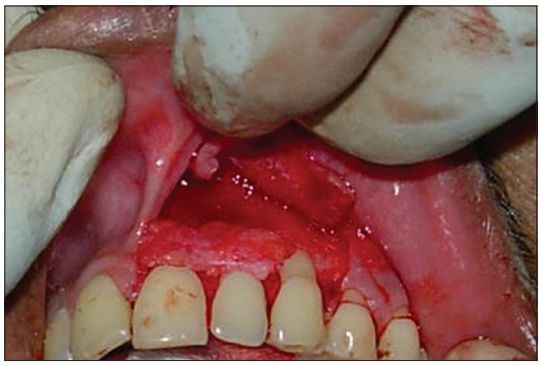

Figure 5: Original size of the connective tissue graft was positioned in the recipient area

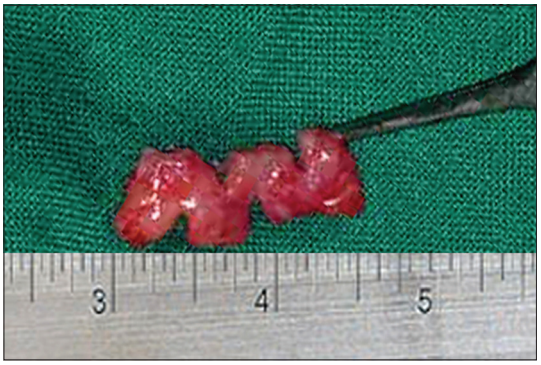

Figure 6: The expanded mesh connective tissue graft

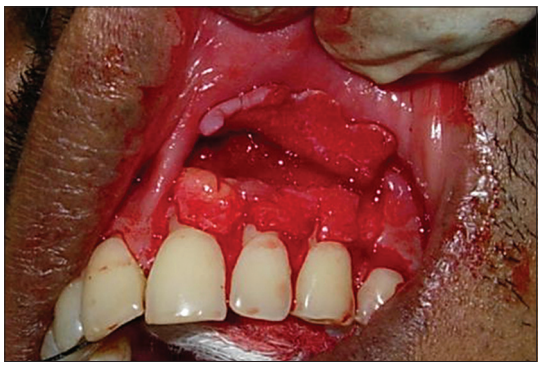

Figure 7: The expanded mesh connective tissue graft was positioned in the recipient area

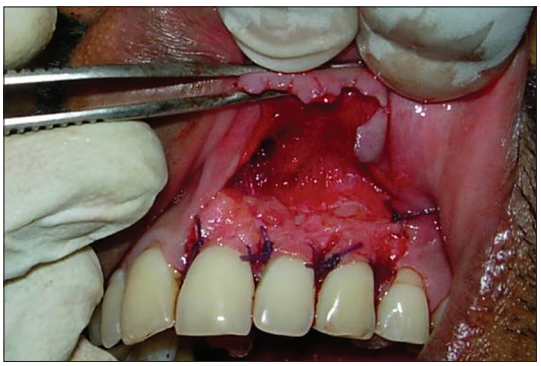

Figure 8: Initial stabilization of the graft with 5-0 absorbable suture

3.71 mm ± 0.61 mm. Three months following surgical intervention, the mean RD reduced from 2.56 mm ± 0.62 mm to 0.61 mm ± 0.63 mm (mean 1.96 mm ± 0.66 mm), the mean root coverage was 86%, the mean RW reduced from 3.44 mm ± 0.44 mm to 1.52 mm ± 1.40 mm (mean 1.92 ± 1.34), the mean KT increased from 2.13 mm ± 0.73 mm to 3.55 mm ± 0.69 mm (mean 1.42 ± 0.62), the PD from 1.15 mm ± 0.23 mm to 1.22 mm ± 0.25 mm (0.07 ± 0.33), and CAL increased from 3.71 mm ± 0.61 mm to 1.83 mm ± 0.70 mm (1.88 ± 0.69). On statistical analysis, there was a significant reduction in RD and RW, and KT and clinical attachment gain at 3 months ($P < 0.001$) compared to the baseline [Table 1].

At the end of 12 months, the mean RD reduced from 2.56 mm ± 0.62 mm to 0.35 mm ± 0.54 mm (mean 2.22 ± 0.68), the mean root coverage was 93.5%, the mean RW reduced from 3.44 mm ± 0.44 mm to 0.77 mm ± 1.16 mm (2.71 ± 1.23), the mean KT increased from 2.13 mm ± 0.73 mm to 3.87 mm ± 0.80 mm (1.75 ± 0.78), the PD from 1.15 mm ± 0.23 mm to 1.20 mm ± 0.25 mm (0.06 ± 0.34), and CAL increased from 3.71 mm ± 0.61 mm to 1.51 mm ± 0.61 mm (2.20 ± 0.68). All parameters were statistically significant ($P < 0.001$) compared to base line except PD ($P > 0.05$) but there was no statistical significance improvement between 3 months to 12 months interval ($P > 0.05$) [Table 2].

At the end of 12 months postoperatively, favorable results were obtained using the e-MCTG procedure. Totally, 44 out of 55 sites, 44 (80%) sites showed 100% root coverage 7 out of 55 sites, 7 (12.7%) sites showed 90% root coverage 4 out of 55 sites, 4 (7.3%) sites showed 65.5% root coverage at the end of 12th months [Figure 12].

Discussion

Gingival recession involves groups of adjacent teeth and is seldom localized to a single tooth. When multiple recession defects affecting adjacent teeth in esthetic areas of the mouth are present, they should all be treated at the same time to help ensure the best esthetic results. Autogenous CTG have been extensively used for root coverage procedures in teeth and implants.[18,19] Whereas subepithelial CTG was extensively used for one or two adjacent gingival recession defects excellent result with color matching.[16]

Harris's study proposed that the use of acellular dermal matrix graft would improve the gingival color, reduce patient morbidity, provide a uniform thickness of material and eliminate the need for multiple surgeries because of unlimited availability.[20]

In the present study, a new approach of the CTG technique was described to cover multiple gingival recession defects. The most common problem for root coverage with CTG procedure is the amount that can be harvested. The rugae area is not suitable for graft material, and an extensive palatal

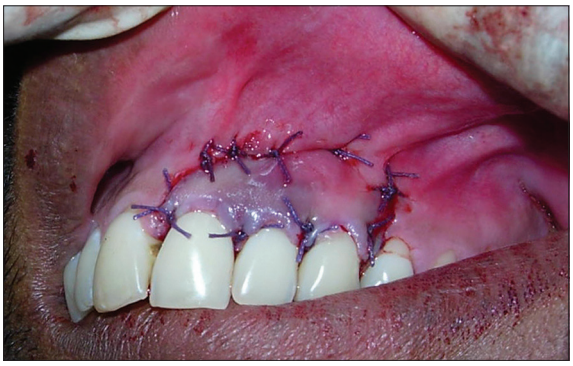

Figure 9: Coronal repositioning of the flap with complete closure

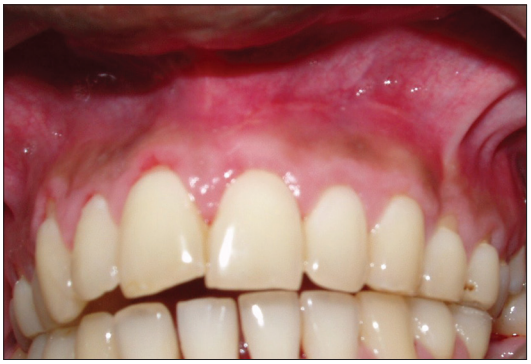

Figure 10: Postoperative facial view at the end of 3rd month [compare with Figure 1]

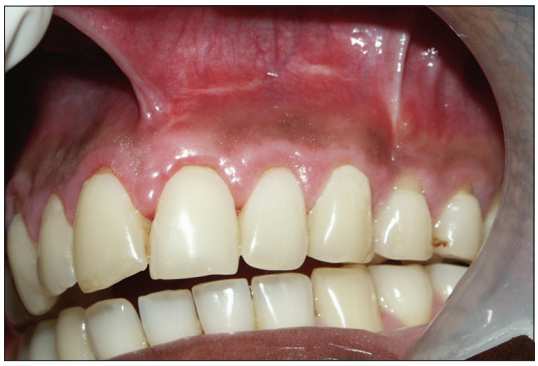

Figure 11: Postoperative facial view at the end of 12th month [compare with Figure 1]

wound will be uncomfortable for the patient. Because of the high rate of complications and a limited amount of palatal mucosa available for grafting, it is advisable to refrain from covering large or multiple defects. Formerly e-MCTG was used for free gingival grafts and was generally applied to increase the width of keratinized tissue without root coverage.[21] We modified this technique to cover multiple gingival recessions sites in one surgery. E-MCTG provides more graft material since it can be expanded as much as 50% to cover a larger area.

This surgical technique resulted in complete root coverage in 44 out of 55 sites. Totally, 44 (80%) sites showed 100% root

Table 1: Mean and SD of baseline and end of 3rd months postoperative parameters (*n*=55 sites)

Parameters	Baseline	End of 3rd months	*P*
RD	2.56±0.62	0.61±0.63	0.000*
RW	3.44±0.44	1.52±1.40	0.000*
WKT	2.13±0.73	3.55±0.69	0.000*
PPD	1.15±0.23	1.22±0.25	0.103†
CAL	3.71±0.61	1.83±0.70	0.000*

*Statistically significant at 99% level (*P*<0.001); †Statistically not significant (*P*>0.05). SD: Standard deviation; RD: Recession depth; RW: Recession width; CAL: Clinical attachment level; WKT: Width of keratinized tissue; PPD: Probing pocket depth

Table 2: Mean and SD of baseline and end of 12th months postoperative parameters (*n*=55 sites)

Parameters	Baseline	End of 12th months	*P*
RD	2.56±0.62	0.35±0.54	0.000*
RW	3.44±0.44	0.77±1.16	0.000*
WKT	2.13±0.73	3.87±0.80	0.000*
PPD	1.15±0.23	1.20±0.25	0.243†
CAL	3.71±0.61	1.51±0.61	0.000*

*Statistically significant at 99% level (*P*<0.001); †Statistically not significant (*P*>0.05). SD: Standard deviation; RD: Recession depth; RW: Recession width; CAL: Clinical attachment level; WKT: Width of keratinized tissue; PPD: Probing pocket depth

coverage, 7 out of 55 sites, 7 (12.7%) sites showed 90% root coverage, 4 out of 55 sites, and 4 (7.3%) sites showed 65.5% root coverage at the end of 12 months regardless of the number of patients treated. This success rate is similar to those previously reported by Cordioli *et al*.,[2] 94.68%; Romangno-Genon[3] 84.84%; Rosetti *et al*.,[22] 95.6%; and Harris[23] 97.7%.

The free gingival graft is commonly applied for increasing the width of keratinized tissue.[5,24] However, it has some limitations and complications such as color match, painful postoperative wound healing, and scar tissue formation in the donor area. It has been reported that using CTG to increase KT has a more rapid, maturation, and less traumatic healing of the graft in the recipient site.[5,22,24] Similar clinical observations were noticed in our study with the use of the e-MCTG technique.

As mentioned in previous studies, an increase in KT may be great when there is a narrow band of attached gingival (≤1 mm) apical to the defects.[11,24] In this study, a significant increase of KT was obtained after surgery and maintained over time for 12 months, and this was comparable to other studies.[2,22,23] On the other hand, we did not achieve complete coverage of the graft in four cases where there were more than three adjacent gingival recession sites and the average amount of KT was 1.5 mm at baseline. The increase in KT in these cases was 2.86 mm at 12 months postoperatively. It is suggested that attempting to cover completely the graft should be avoided when the initial height of keratinized tissue is poor.

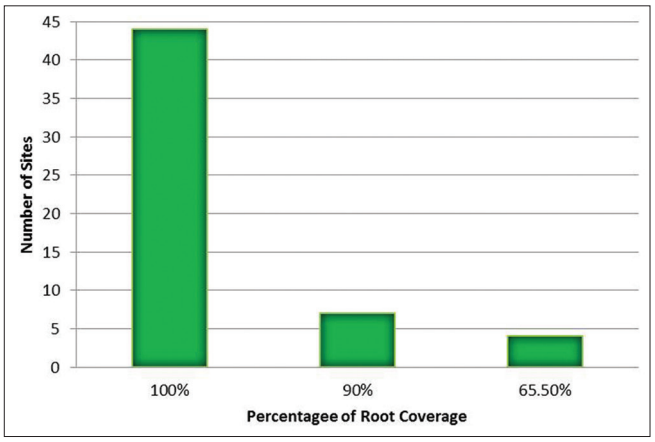

Figure 12: Percentage of root coverage at the end of 12 months

The mean gain in CAL was 2.20 mm ± 0.68 mm at 12 months follow-up. The tissue was tightly bound to the tooth in most cases and resisted probing. Histological studies have demonstrated that the blood supply from the periosteum and overlying flap results in a more rapid re-establishment of circulation.[1,25] In the present study, we took care to place the graft with the periosteal side facing the root surface.

Borghetti and Gardella[26] are documented that creeping attachment may continue for 1-year postoperatively, when thick grafts were used. In this study, there was no statistically significant creeping attachment between the 3rd and 12th months interval. However, five patients did show a 1 mm improvement in attachment from the 3rd to 12th month.

Recently, an acellular dermal matrix has been shown to be effective in root coverage procedures as a substitute for CTG. Tat *et al*.[27] and Wei *et al*.[28] have shown that acellular dermal matrix was not as successful as the autogenous free graft and connective tissue free graft in increasing the KT, and a histologic report suggested that placing an acellular dermal matrix does not increase KT.[29]

Conclusion

CTG is the gold standard for treatment of gingival recession, but the disadvantages are the inadequate graft availability. The results of the present study demonstrated that the e-MCTG procedure was an effective and predictable treatment modality for the management of multiple adjacent gingival recessions in terms of root coverage in the treatment of multiple adjacent gingival recessions.

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