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CASE REPORT

SURGICAL TREATMENT OF MULTIPLE GINGIVAL RECESSIONS WITH TUNNEL TECHNIQUE USING FREE GINGIVAL GRAFT: CLINICAL CASE SERIES

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ABSTRACT

Background: Mucogingival periodontal surgery is a surgical procedure to correct defects in the morphology, position, and/or quantity of soft tissue and underlying bone support around teeth. Various methods can be performed for the surgical management of the recession defects of gingiva. Different surgical techniques have been advocated for root coverage, like free soft tissue graft procedures, free gingival graft and sub-epithelial connective tissue graft, pedicle soft tissue graft, rotational flap and flap advancement, pouch and tunnel techniques and guided tissue regeneration. Free gingival graft is a reliable mucogingival surgical procedure to cover localized gingival recessions.

Objective: The aim of this case series was to evaluate the results obtained by the surgical treatment of multiple gingival recessions with tunnel technique using free gingival graft.

Materials and Methods: This case series included 18 patients with localized multiple gingival recessions who underwent surgical treatment using free gingival graft from 2023 to 2025. The Miller and Cairo classifications was used to classify gingival recession. The following clinical parameters were measured:Probing pocket depth (PD);Clinical attachment level (CAL);Recession depth (RD) ;Recession width (RW). Professional hygiene was performed before surgical treatment.

Free gingival graft was used to close the recession in all patients. Evaluations of clinical changes (recession depth, height of keratinized tissue) and patient satisfaction were performed over a follow-up period of 12 months.

Results: Adequate keratinized gingival width, thickening of the gingival phenotype, and treatment of recession were observed at follow-up appointments on the 3rd month and 12th month. At baseline, six months, and one year postoperatively, clinical measurements demonstrated the effectiveness of free gingival graft in improving soft tissue parameters in cases of gingival recession. All patients complained of hypersensitivity before surgery, and six months after treatment, a third percentage of patients reported mild hypersensitivity complaints. All patients were satisfied with the aesthetic results of the procedure.

Conclusion: Free gingival graft can be used as a predictive treatment modality for recession defects and the results can be well maintained with optimal care and patient satisfaction.

Keywords:Free gingival graft, gingiva, gingival recession, mucogingival surgery, tunnel technique

INTRODUCTION

Gingival recession is a common pathology that occurs when the gingival margin migrates apical to the cementoenamel junction (CEJ) of one or more teeth. Recession is a decrease in the volume of gum recession, which leads to exposure of the neck and roots of the tooth.[1]

The etiology of gingival recession is multifactorial and may be caused by a variety of factors.[2-4]

Etiological factors gingival recession:

- Periodontal disease;
- Mechanical forces;
- Iatrogenic factors;
- Anatomical factors.

Recession can be caused by such problems as crowded teeth and their incorrect positioning. It develops due to overload of individual teeth.

Orthodontic treatment is used to eliminate it. Incorrect structure and attachment of the frenulum. Recession in this case develops due to injury to the area of attachment of the frenulum to the gum. The cause is eliminated with the help of frenuloplasty. Violation of hygiene causes inflammatory diseases of the periodontium, such as gingivitis, periodontitis. In this case, tooth mobility, formation of pockets, bad breath, and suppuration from the gums can be observed. As a result of the destruction of bone tissue and gums around the tooth, recession appears. One of the common causes of recession is trauma to the mucous membrane. Incorrect aggressive brushing and flossing, using toothpicks, bad habits are common causes.

Gingival recession can be painful due to hypersensitivity of the dentin of the exposed root surfaces of the tooth and can also cause a deterioration in the aesthetic appearance.

Classification of gingival recession

Miller (1985)[5] proposed a classification of recession based on the height of the interdental bone adjacent to the defective area (table 1)and the relationship of the gingival margin to be used as a basis for determining treatment options.[6]

Table 1. Miller's classification of gingival recession defects (1985).

Class I	Recession within attached gingiva. No loss of interdental bone and soft tissue papillae covering interdental bone at full height
Class II	Recession extending to or beyond the mucogingival junction. No loss of interdental bone and soft tissue papillae covering interdental bone at full height
Class III	Recession extending to or beyond the mucogingival junction. Loss of interdental bone but interdental bone height coronal to apical extent of recession defect. Reduction in height of the soft tissue papillae covering interdental bone
Class IV	Recession extending to or beyond the mucogingival junction. Loss of interdental bone apically to recession defect. Gross flattening of interdental soft tissue papillae

Initial recession (IR): Measured in mm from the CEJ to the most apical gingival margin of the recession.

When choosing a treatment method for gum recession, it is important to consider the etiological factors and the degree of tissue involvement.

The following types of operations are used to eliminate recession:

CAIRO CLASSIFICATION (2011) Gingival recession based on the Assessment of CAL at both buccal and interproximal sites.

Type 1: Gingival recession with no loss of interproximal attachment. Interproximal CEJ was clinically not Detectable at both mesial and distal aspects of the tooth.

Type 2: Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment Loss (measured from the interproximal CEJ to the depth of the interproximal Pocket) was less than or equal to the Buccal attachment loss (measured from the buccal CEJ to the depth of the buccal Pocket)

Type 3: Gingival recession associated with loss of interproximal attachment. The amount of interproximal attachment Loss (measured from the interproximal CEJ to the depth of the pocket) was Higher than the buccal attachment loss (measured from the buccal CEJ to the Depth of the buccal pocket)

1.Pedicle soft tissue grafts

Closing the recession with local tissues. In this case, the mucous membrane is moved from areas adjacent to the tooth. Additionally, special membranes are used to restore tissue. This technique can be used for mild to moderate severity of the disease. Procedures for transplanting soft tissues on the leg. These types of grafts remain attached to their base and presuppose the placement of soft tissue over the recessional defect; they save their blood supply when moving to a new place. Examples include:

• Procedures with rotating flap, including lateral flap, double papillary flap.

• Procedures for moving the flap, including the flap for repositioning the crown.

2. Free gingival grafts

Closing the recession with a free palatal flap. In this case, a mucous graft is taken from the palate. Artificial membranes are also used. The technique of transferring soft tissues from a distant area of recession is used when there is a lack of donor tissue near the recipient site.

3.Coronally advanced flap

The coronal flap is used to treat Miller class I and II recession defects.[10] This technique is however, only when adequate keratinized tissue is present.[11]It is relatively simple, providing good aesthetic results. It is performed by making two vertical incisions extending beyond the mucocutaneous junction and

lifting a full-thickness flap, which is repositioned in a coronal position and sutured in place.[12]

This surgical approach allows for restoration of the original gingival morphology, provides color to the resected area of the recession, and has a low morbidity rate, with patients undergoing this procedure.

4.Semi-lunar flap

A modified version of Coronally advanced flap is the crescent semi-lunar flap procedure, first proposed by Tarnow in 1986. This technique allows for partial thickness flap resection to avoid alveolar bone flaps.

Laterally positioned grafts

This method is indicated for narrow defects with attached gingivae at the donor site.[13]To provide root coverage, the marginal gingival tissues around the tooth are incised with an oblique incision at the base of the gingival pocket. Incisions are made in the gingival margin and interdental papilla of the donor site.[14,15]

Free gingival graft transplantation Procedures

Free gingival grafts are used for:

• Increasing the amount of keratinized tissue (more specifically attached gingiva)

• Increasing the vestibular depth

• Increasing the volume of gingival tissues in edentulous spaces (preprosthetic procedures)

• Covering roots in areas of gingival recession.

Free gingival grafts, include:

- Connective tissue grafts.
- Subepithelial tissue graft.

The technique is used for moderate to severe disease.

The choice of surgical technique for recession is dictated by a number of factors, including the size of the tooth recession defect, the presence or absence of keratinized tissue adjacent to the defect, the width and height of the interdental soft tissue, the depth of the vestibule or the presence of a frenula.[7] The desired aesthetic outcome and the predictability of the expected results are also important.[8,9]

Before recession closure, root surfaces are mechanically thoroughly cleaned with ultrasonic or hand instruments and irrigated with sterile saline. They are then treated with citric acid or tetracycline hydrochloride.

Free soft tissue grafts lack a blood supply and, as an embedded graft, rely on the nutrient supply of serum from their recipient's bed. Although free gingival grafts are usually harvested from the palate and sutured into position at the recipient site, the recipient bed should extend at least 3 mm lateral and apical to the recession defect, as this will be the only nutrient supply to the graft during the initial healing phase. Care should be taken to avoid palatine blood vessels.[16]

Good adaptation of the flap to the underlying tissues is essential for adequate diffusion, so care should be taken in preparing the recipient's bed and cutting the graft to the exact size required to ensure good fit.

Free gum grafting can compromise esthetics due to the color difference between the graft and the recipient tissue, as well as the painful appearance of a large exposed area in the palate and discomfort to the patient.

In contrast to this method, in the case of connective tissue (CT) grafting, the color match with the recipient tissue is much better. There is less pain at the donor site because the wound surface is closed, which reduces the patient's discomfort. Connective tissue graft is harvested from the palate if there is an adequate thickness of tissue. IF the space is sufficient, it can also be taken from the Retro-molar pad area due to the thickness of the submucosal membrane in this area.

Among the various surgical approaches used to treat gingival recession, connective tissue grafting combined with a gingival flap can be considered the gold standard for the treatment of recession defects.[17,18]

Since the success rate of root capping depends on the survival of the graft tissue itself, it has been suggested that the capping should cover the majority of the graft. This is thought to provide sufficient blood supply to nourish the lower part of the graft on the exposed root.[19]

Allen (1993) proposed the use of a technique in which a connective tissue graft is placed in a tunnel preparation.[20]

This technique allows for the preservation of a thicker cap at the apex of the recession to cover the exposed root surface in the case of multiple adjacent recession defects.[21-24]

One of the concerns about harvesting the graft tissue is the potential risk of damaging the greater palatine artery due to variation in the anatomy of the palatal vault.[25]

Additive treatments:

- Root surface modification agents;
- Enamel matrix proteins;
- Guided tissue regeneration;
- Nonresorbable barrier membrane;
- Resorbable barrier membrane.

After periodontal surgery, it is very important to monitor the wound healing process. It is necessary to apply a topical preparation that will protect the

wound from the harmful effects of oral microflora and enhance wound regeneration, such as the properties of hyaluronic acid. In dentistry, it was first used in the treatment of periodontal diseases (gingivitis).[26-28]

Hyaluronic (HA) acid plays a multifunctional role in wound healing processes. Hyaluronic acid can increase local immunity in the oral cavity, enhance the antibacterial function of cells, improve tissue regeneration, which has a positive effect on the healing process, and can be a good drug in the treatment of oral wounds. It enhances tissue regeneration, wound healing properties and stimulates the migration of fibroblasts and cell proliferation.[29,30]

Hyaluronic acid is a polysaccharide, a polymer of glucuronic acid and N-acetylglucosylamine, and a member of the high molecular weight glycosamine family. Hyaluronic acid (Hyaluronan) is an unchanged, indispensable component of healthy gingival and oral mucosal tissue.[31]

It has many properties that make it a good drug for wound healing, promoting early granulation tissue formation, inhibiting inflammation, stimulating epithelial turnover, and also angiogenesis of connective tissue.

Various authors have reported the effectiveness of the use of hyaluronic acid in periodontal therapy: it reduces pain and swelling and accelerates the regenerative process in soft tissues.[32,33]

Considering these properties of hyaluronic acid, we have included Gengigel® in postoperative period.

The aim of this case series was to evaluate the results obtained by the surgical treatment of multiple localized gingival recessions with tunnel technique using free gingival graft.

MATERIALS AND METHODS

This case series included 18 patients with localized multiple gingival recessions who underwent surgical treatment with tunnel technique using free gingival graft from 2023 to 2025. The Miller and Cairo classification was used to classify gingival recession.

Inclusion criteria:

- Patients without systemic diseases;
- Miller's gingival recession of different classes in one or more teeth;
- Shallow vestibule (<5 mm);
- No active signs of periodontal disease;
- Do not smoke.

Exclusion criteria:

- Patients with systemic diseases or taking medications contraindicated for periodontal surgery;
- Active signs of periodontal disease;
- Para-functional habits;
- Poor oral hygiene;
- Presence of cervical caries;
- Pregnant or breastfeeding patients.

All subjects were informed about the study and clinical procedures and provided written consent.

The following clinical parameters were measured: Probing pocket depth (PD);Clinical attachment level (CAL);Recession depth (RD);Recession width (RW).

4 weeks before surgery, professional hygiene was performed and patients underwent professional oral hygiene instructions.

Surgical Procedure

After local anaesthesia, root planing of the exposed root surfaces was performed by means of hand instruments (Gracey Curettes, Hu-Friedy, Chicago, IL, USA). Subsequently, intrasulcular incisions were placed and mucoperiosteal flaps were raised using sharp tunnel elevators (Hu-Friedy, Chicago, IL, USA) The flaps were extended beyond the mucogingival junction and under each papilla to allow passive, tension-free mobilization in coronal direction .Remaining collagen bundles on the inner surface of the flap were carefully cut using Gracey curettes until passive coronal displacement of the flaps and papillae was obtained. Great care was taken to avoid flap perforation.

A FGG immediately harvested from palatal side using N°15 blade after tunnel preparation..

Immediately after FGG harvesting, the donor site was sutured with continuous suture using 5/0 nonabsorbable sutures and hemostatic sponge was placed. FGG was deepithelialized with 15c blade.

CTG was inserted under the tunnelled flap by starting at the deepest recession (Figs. 2b and 3b). Subsequently, the grafts were pulled laterally towards each end of the tunnel by means of mattress sutures with 5/0 absorbable suture(LUXCRYL PGA: Weiswampach, Luxemburg). Finally, the flap was positioned coronally to the CEJ using sling sutures.(Figs. 2c and 3c). Anchored sutures were placed to keep the flap coronally .

Post-surgical protocol

Post-surgically, all patients were given analgesics (3 9 50 mg Cataflam, Budapest, Hungary) for 3 days and antibiotics (3 9 625 mg Augmentin, Pfizer KFT, Budapest, Hungary) for 7 days due to university

regulation for implantable biological materials. Patients were instructed to rinse their mouth with a 0.2% chlorhexidine solution, two times a day for 1 min. for 3 weeks. Patients were instructed to avoid brushing in the operated area until suture removal at 2 weeks. Patients underwent manual supragingival tooth cleaning twice a week until suture removal. At suture removal 2 weeks after surgery, all patients were controlled and instructed in mechanical tooth cleaning of the operated areas using a soft tooth brush and a roll technique. All patients were recalled after 28 days, 3, 6 and 12 months and received one session of prophylaxis, including reinforcement of oral hygiene, supragingival debridement and tooth polishing. The study was completed in 1 year.

Results: No intraoperative complications occurred, and postoperative swelling was rare, no partial graft necrosis was observed, and mild varicocele pain in the donor site was reported in all patients. Adequate keratinized gingival width, thickening of the gingival phenotype, and treatment of recession were observed at follow-up appointments on the 3rd month, and 12th month.At baseline, six months, and one year postoperatively, clinical measurements demonstrated the effectiveness of free gingival graft in improving soft tissue parameters in cases of gingival recession. All patients complained of hypersensitivity before surgery, and six months after treatment, a third percentage of patients reported mild hypersensitivity complaints. All patients were satisfied with the aesthetic results of the procedure. The results of all clinical parameters obtained are summarized in Table 2.

Table 2. Clinical parametrs patienents (n=18) after 3 months, 6 months, 1 year

Clinical parametrs	Baselin	After 3 months	After6 months	After One year
Probing pocket depth (PD)	1	0	0	0.8
Recession depth (RD)	4	0	0	0
Recession width (RW)	3	0	0	0

Case Report 1

This clinical case report is about a 33-year-old woman whose main complaint was 23 tooth sensitivity and esthetic problems. The patient had no history of systemic health or abnormal habits. On periodontal examination and radiographic evaluation, the patient was diagnosed with 23 tooth Miller Class III gingival recessions,24 tooth Miller Class II gingival recessions,25 and 26 tooth Miller Class I gingival recessions (fig.1).

Figure 1. Preoperative view gingival recession in 23,24,25,26 teeth.

The patient was presented with the treatment protocol and after obtaining written consent, the treatment process began. Before periodontal surgery, professional dental hygiene was performed.

Clinical Records

Clinical examination revealed a healthy periodontium with gingiva showing no signs of bleeding on probing. The following clinical parameters were measured:

Probing pocket depth (PD)was measured with a standard periodontal probe to the nearest millimeter from the gingival margin to the bottom of the sulcus;

Recession depth (RD) was measured from the CEJ to the gingival margin;

Recession width (RW) was measured across the buccal surface at the CEJ.

Surgical Procedure

Recipient Site Preparation

A horizontal intrasulcular incision was made at the CEJ level (figure 2) Mucoperiosteal flap was raised using sharp tunnel elevators (, Hu-Friedy, Chicago, IL, USA) The flaps were extended beyond the mucogingival junction and under each papilla to allow passive, tension-free mobilization in coronal direction .Remaining collagen bundles on the inner surface of the flap were carefully cut using Gracey curettes until passive coronal displacement of the flaps and papillae was obtained (figure 3).

Figure 2. Intrasulcular incision
Figure 3. Separation of the flap

A 2 mm thick graft consisting of epithelium and underlying connective tissue layer was harvested from the palate donor site (Figure 4,5).

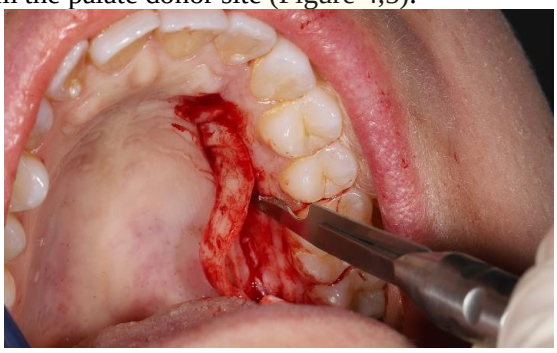

Figure 4. Harvesting a free gingival graft from the palate

Figure 5. Free gingival graft

Palatal side was sutured with 5/0 nonabsorbable suture and covered with hemostatic sponge (figure 6)

Figure 6. Palate after suturing

After de-epithelialization free gingival graft was then placed in the tunnel and sutured to the lateral margins. Finally, the flap was positioned coronally to the CEJ using sling sutures. Anchored sutures were placed to keep the flap coronally (figure 7). Periodontal dressing Gengigel® (0.8% hyaluronic acid) was placed over the donor site and recipient site. A periodontal dressing was applied to the surgical site for 10 days.

Figure 7. Free gingival graft sutured

The patient was advised not to brush the treated site for 4 weeks. 0.12% chlorhexidine mouth rinse was prescribed twice a day for 4 weeks. Antibiotics and analgesics were administered as needed. Sutures were removed 3 weeks after surgery. Patient was examined weekly for the 1st month and then once a month for the next 3 months (figure 8,9), one year postoperative. Patient was recalled at 3 months intervals for oral hygiene instructions.

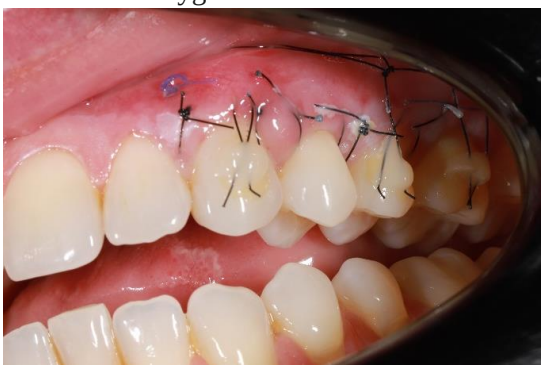

Figure 8. 2 weeks postoperative

Figure 9. 10 weeks postoperative

Figure 10. One year postoperative

After treatment, all parameters improved There was a significant reduction in RD, RW and probing PD were observed at the end of 1 year compared to baseline values.

Case Report 2

The patient is a 21-year-old female patient complaining of esthetics of the frontal part of the lower jaw. There is recession Miller Class III 31 tooth, Miller Class II 41 tooth teeth (fig.11).

Figure 11. Preoperative view gingival recession in 31,41 tooths.

The patient was presented with the treatment protocol and after obtaining written consent, the treatment process began. Before periodontal surgery, professional dental hygiene was performed.

Clinical Records

Clinical examination revealed a healthy periodontium with gingiva showing no signs of bleeding on probing. The following clinical parameters were measured;Probing pocket depth (PD); Recession depth (RD); Recession width (RW).

Surgical Procedure

Recipient Site Preparation

A horizontal intrasulcular incision was made at the CEJ level (figure 11) Mucoperiosteal flap was raised using sharp tunnel elevators (Hu-Friedy, Chicago, IL, USA). The flaps were extended beyond the mucogingival junction and under each papilla to allow passive, tension-free mobilization in coronal direction.Remaining collagen bundles on the inner surface of the flap were carefully cut using Gracey curettes until passive coronal displacement of the flaps, papillae was obtained and prepared tunnel (figure 12,13,14).

Figure 12. Intrasulcular incision

Figure 13 Tunnel design with a gum knife

Figure 14. Prepared tunnel

Harvesting a free gingival graft from the palate

A 2 mm thick graft consisting of epithelium and underlying connective tissue layer was harvested from the palate donor site and de-epithelialization of the transplant (figure 15,16,17).

Figure 15. Free gingival graft harvested from the palate

Figure 16. The donor area in the palate after the transplant was taken.

Figure 17.De-epithelialization of the transplant

Free gingival graft from the palate was then placed in the recipient site and sutured and fixation in the tunnel (figure 18,19,20). The graft was held firmly in place using digital pressure for 5 minutes, and periodontal dressing Gengigel® (0.8% hyaluronic acid) was placed over the donor site and recipient.

A periodontal dressing was applied to the surgical site for 10 days. The patient was advised not to brush the treated site for 4 weeks. 0.12% chlorhexidine mouth rinse was prescribed twice a day for 4 weeks. Antibiotics and analgesics were administered as needed. Sutures were removed 10 days after surgery.

Figue 18**.** Placement of the transplant in the recipient area and fixation in the tunnel

Figure 19. The wound was closed with parasitoid sutures; composite sutures were placed on teeth 32, 31, 41, and 42 to fix the flap in place.

Figure 20. 3 days later

Patient was examined weekly for the 1st month and then once a month for the next 3 months (figure 21, 22). Patient was recalled at 3 months intervals for oral hygiene instructions.

Figure 21. After 13 days postoperative

Figure 22. Palate after 13 days

After treatment, all parameters improved. There was a significant reduction in RD, RW and probing PD were observed at the end of 1 year compared to baseline values (figure23,24).

Figure 23. 6 months later postoperative.

Figure 24. One year postoperative

DISCUSSION

Currently, free gingival grafting is considered a predictable and effective procedure for covering bare root surfaces.[34-36] This grafting method relies on the blood plasma circulation of the gingival tissue to the periosteum of the recipient bed, there should be no dead space between the graft and the recipient area for the survival of the free flap, and immobilization of the graft is important.[5] Treatment of a patient with gingival recession should begin with correction of etiological factors. Numerous therapeutic solutions for recession defects have been proposed in the literature and have been modified with time according to the evolution of clinical knowledge. Various surgical procedures, including the lateral sliding flap, coronal progressive flap, and their combinations with barrier membranes or subepithelial connective tissue grafts, have been proposed for the treatment of single-tooth gingival recession, and the selection of effective procedures and the skill of the surgeon are essential for successful results. [37]

Revascularization of the graft takes several days, and good adaptation of the flap to the underlying tissues is necessary to maintain tissue viability. Attention must be paid to preparing the recipient bed and the

exact size of the graft cut. Proper flap design is also an important step in obtaining satisfactory flap results. The bag and tunnel techniques have been developed to increase the efficiency of the procedure.

The envelope technique was proposed by Raetzke (1985) to eliminate vertical incisions, which has the advantages of preserving the flap's blood supply, close adaptation to the graft, and reducing postoperative discomfort and scarring.[38] Main disadvantage of FGG is two donor site, donor site morbidity. For the treatment of multiple-tooth gingival recession, various types of allografts or substitute biomaterials have been used instead of connective tissue grafts to reduce patient discomfort.

Subepithelial connective tissue graft has exhibited the optimal clinical outcome.[39-43]There are limitations when multiple teeth are recession-prone and their roots need to be covered or when the palatal tissue thickness is very thin. Due to the color mismatch of the free gingival grafts were deepithelialized.

Zucchelli et al. reported that deepithelialized free gingival grafting for root coverage was as effective as the subepithelial connective tissue grafting technique.[7]

This case series study predictability of free gingival graft in management of gingival recession. The aim of this paper is to present18 cases for the management of gingival recession and increasing the width of attached gingiva in Miller's class II and III recession using free gingival graft. Non-surgical phase along with scaling and root planning was conducted and patient was educated for plaque control. Recipient site prepared by giving one horizontal incision and two vertical incisions up to the vestibule from mesial and distal line angle of adjacent tooth with 15c blade, graft is closely adapted over the recipient and sutures, periodontal dressing use of hyaluronic acid(Gengigel®).

The current study has limitations due to the small number of cases presented, which did not cover all aspects of the classification of mucosal deformities. Therefore, there is a need for a larger number of cases and a longer observation period.
A satisfactory outcome can be achieved for surgical intervention for recession if an objective classification is made, with a thorough understanding of the etiological origin and the selection of appropriate surgical procedures.

Within the limitations of the present case report, free gingival graft can be used as a predictive treatment modality for recession defects and the results can be well maintained with optimal care and patient satisfaction.

DECLARATIONS

Competing interests
No competing interests
Ethics approval and consent to participate
The study was reviewed and approved by the Ethics Committee, Yerevan State Medical University and in accordance with those of the World Medical Association and the Helsinki Declaration. Informed consent
Patients were informed verbally and in writing about the study and gave written informed consent.
Consent for publication
Not Applicable.
Funding
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