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**RESEARCH ARTICLE**

**The Effect Of Periosteal Inverted Graft On Root Coverage Outcomes.**

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**Abstract**

**Background:** Gingival Recession defects are one of the most common defects for which patients seek periodontal treatment. Many treatment options are available for the management of gingival recession. Most of the treatments aim to treat the cause, cover the denuded root surface and produce a long term aesthetic result. The use of periosteal inverted graft is a recent innovation for the treatment of gingival recession defects and has gained much attention in a short span of time.

**Methods:** This study was planned to evaluate the efficacy of periosteal inverted graft in Miller's class I and II single gingival recessions. This study consists of 20 cases of single gingival recession patients who came to the faculty of dentistry .

The follow up includes measurement of the recession depth and width before and after 1, 3 and 6 months after the surgery.

**Results and conclusion :** There was a statistically-significant reduction in the Gingival recession depth and gingival recession width from baseline to 6 months.

The percentage of coverage after 6 months, the recession was 85.9% in class I and 82% in class II .

The inverted periosteal graft can be used for the treatment of gingival recession defects successfully.

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**Introduction:-**

Gingival recession is a characteristic clinical finding in periodontal disease that is commonly associated with esthetic concerns, root hypersensitivity and root caries. It is defined by the American Academy of Periodontology as the migration of the gingiva to a point which is apical to the cemento-enamel junction.<sup>1</sup>

Gingival recession can be localized or generalized, and could be associated with one or more tooth surfaces and reflects exposure of the root cementum<sup>2,3</sup>. It is commonly found in populations with high standards of oral hygiene as well as in populations with poor oral hygiene. The most common etiological factors include periodontal disease, aggressive tooth brushing, aberrant frenal attachment, inflammation, improper flossing, incorrect occlusal relationships and prominent roots.

The management of gingival recession and its sequelae is based on a meticulous assessment of etiological factors and the degree of tissue involvement. Relatively, a recent evidence regarding the treatment of gingival recession

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defects indicates that surgical therapeutic approaches are highly predictable for Miller's class I and II single-tooth defects.

Various root coverage procedures have been successfully performed to correct this common periodontal problem. However, achieving a predictable outcome of such procedures is still a challenge for periodontists.

The total coverage of exposed root surface remains a problem for most clinicians because non-vascular nature of the root surface hampers the ability of most of the graft to survive on the root surface. The objective of the surgery is not only to arrest and cure a disease process but also, if possible to regenerate any lost tissue, which is the goal of root coverage procedures.

Pedicled flaps are probably the simplest procedures for managing gingival recession. Several treatment modalities have been used such as pedicle flaps, coronally advanced flaps (CAFs), and a combination of techniques such as subepithelial connective tissue grafts<sup>4</sup>. These procedures hold some drawbacks as there is a requirement for the second surgical site, morbidity associated with procuring donor grafts, discomfort and poor color match<sup>4,5</sup>.

Despite the fact that SCTG is considered to be the golden standard for the treatment of GRD the search for a technique which eliminates the inherent limitations associated with SCTG (two surgical sites, increased patient trauma, postoperative complications) is still on. The use of acellular dermal matrix graft and GTR membranes has also been proposed to improve patient's outcomes in addition to clinical outcomes, but the techniques have failed to gain the popularity due to the associated increased cost of treatment and uncertain predictability of these procedures<sup>6</sup>. Norberg first proposed coronally positioned flap in 1926 as an esthetic surgical procedure for root coverage<sup>7</sup>.

Initial designs of coronally advanced flap (CAF) have been frequently modified by several clinicians to obtain more predictable results. However, it appears that CAF alone is less than the optimal technique to achieve root coverage despite its advantage of low morbidity. The predictability can be increased by combining CAF or its modified approach with other techniques which may involve the use of connective tissue graft, enamel matrix derivative, synthetic allograft, platelet-rich plasma and platelet-rich fibrin (PRF).

The purpose of developing newer methods for root coverage is to increase predictability, reduce the number of surgical sites and improve patient's comfort all together with the need to reconstruct the lost periodontal tissues. There is a need for a graft which has its own blood supply, which can be harvested adjacently to the recession defect in sufficient amounts without requiring any second surgical site and has the potential to promote the regeneration of lost periodontal tissue. The adult human periosteum is highly vascular and is known to contain fibroblasts and their progenitor cells, osteoblasts and their progenitor cells and stem cells.

In all age groups, the cells of the periosteum retain the ability to differentiate into fibroblasts, osteoblasts, chondrocytes, adipocytes and skeletal myocytes. The tissues produced by these cells include cementum with periodontal ligament fibers and bone<sup>8</sup>. Although osteogenic potential of the periosteum has received considerable attention as a grafting material for the repair of bone and joint defects<sup>9</sup>, there isn't any study that has mentioned the use of periosteum for the treatment of gingival recession defects. The purpose of this study was to demonstrate a technique that utilizes the periosteum as an autograft for the treatment of gingival recession defects.

It has been almost 9 years since the periosteal graft was first introduced to the treatment of gingival recession defects (GRD) as pedicle graft. The detailed technique utilizing the periosteum as a pedicle and the term "Periosteal Pedicle Graft (PPG)" for the treatment of single tooth GRD were first published in the Australian dental journal in 2009<sup>10</sup>, later the technique was successfully used to treat adjacent multiple gingival recession defects for the first time in 2011<sup>11</sup>.

In a small time frame, periosteal graft has drawn a great deal of attention from the dental fraternity, especially from the periodontal surgeons. Although the use of periosteum in surgical fields is not new, researchers have proven the ability of periosteum to regenerate the lost tissues especially the bone, the use of periosteum in dentistry is still limited. In the past, few studies have been done to utilize periosteum as a barrier membrane in bone regenerative procedures but recently the immense regenerative potential of the periosteum has been underscored, and emphasis has been made to utilize the same<sup>12</sup>. The use of periosteum for the treatment of GRD was suggested based on the following facts<sup>12</sup>.

Patients are more satisfied with procedures that require minimum intra-operative trauma and postoperative complications hence periosteal graft scores better in terms of patient satisfaction over SCTG.

### Materials and Methods:-

This study is prospective randomized blind clinical study.

A group of 20 Patients (females and males) at the age of  $\geq 18$  years were randomly selected from the outpatient department at the Department of Periodontics, Tishreen University ,Latakia ,Syria; with isolated gingival recession defects in relation to labial aspect of maxillary teeth(except molars). Cases were chosen based on the following inclusion criteria: Miller Class I or II recession, non-compromised systemic health and no contra-indication for periodontal surgery . The mean thickness of attached gingiva  $\geq 1.25$  and the involved tooth were freed from periapical pathology.

Exclusion criteria was: smokers and chewers of tobacco, root surface restorations on sites, pregnant and lactating women, use of fixed orthodontic or removable appliances ,irregular placement of the dental concerned, periodontitis and a previous root coverage procedure at recession sites.

The required instruments and materials :

1. Assessment instruments (mouth mirrors ,periodontal probes )
2. Therapeutic instruments (scalers ,curettes )
3. Surgical instruments( incisional instruments, periosteal elevators ,surgical curettes and sickles, scissors ,tissue forceps, needle holders )
4. Blades 15 /15c
5. Lidocaine 2% with epinephrine 1:80000
6. Non-absorbable surgical sutures (polypropylene 4-0 )

The procedure was explained to the patients and a written informed consent was taken. The non-surgical phase included supragingival scaling and root planning by both ultrasonic and hand instruments, followed by oral hygiene instructions. The recorded clinical parameters were: depth of recession, width of recession. These recordings were taken at baseline and 6 months post operatively.

1. GR depth (GRD) calculated from the cemento-enamel junction (CEJ) to the free gingival margin at the center of facial surface <sup>13,14</sup>
2. GR width (GRW) calculated across the labial surface and at CEJ <sup>13,14</sup>
3. Complete or partial root coverage <sup>13,14,15</sup> was estimated using the following formula:

Postoperative recession depth – preoperative recession depth \* 100

Preoperative recession depth at baseline.

The surgical procedure was carried out 3 weeks after the non-surgical phase. Patients were subjected to pre-procedural rinsing with chlorhexidine gluconate.( Fig 1).

All the surgeries were performed under local anaesthesia using 2% lidocaine containing 1:80000 epinephrine. Once the area was anaesthetized, with a blade number 15C, horizontal incisions were made perpendicular to the adjacent interdental papillae at the level of the CEJ preserving the gingival margin of the affected teeth along with sulcular incisions on the buccal aspect of the involved teeth. At the line angles of the distal most and the mesial most teeth, vertical incisions extending beyond the mucogingival junction were given. A partial thickness flap was then elevated till an adequate amount of periosteum was exposed (Fig 2).

A horizontal incision was then given at the apical extent of the periosteum where it was attached to the bone. A periosteal elevator was used to separate the periosteum from the underlying bone, and was reflected coronally to an extent where it was still attached to the bone (Fig 3).

The reflected periosteum was then inverted in which the cambium layer covers the denuded root. (Fig 4).

Once it was in place. The reflected partial thickness flap was coronally advanced such that it covered the periosteum and was sutured using a sling suture. The vertical incisions were sutured using an interrupted suture (Fig 5). The operated site was protected by placement of a periodontal dressing (voco-pac). Post-operative instructions were given. All the patients were prescribed antibiotics and analgesics and anti-tumefacient.

Amoxicillin-500 mg to be taken thrice daily for 5 days.

Brufen to be taken twice daily for 2 days and Bromelains to be taken thrice daily for 2 days.

The patients were asked to report to the dental clinic after 15 days for the removal of the periodontal dressing and the sutures. The treated areas were irrigated with povidone iodine. The surgical area was healing uneventfully.

Follow up :

1. After 1 month .
2. After 3 months (Fig 6) .
3. After 6 months (Fig 7).



**Fig 1:-**The case before surgery, Single gingival recession.



**Fig 2:-**Coronally advanced flap.



**Fig 3:-**Reflect the periosteum.



**Fig 4:-**Inverted periosteal graft.



**Fig 5:-**suturing with polypropylene 4-0



**Fig 6:-**After 3 months.



**Fig 7:-**After 6 months.

### Results:-

Healing was uneventful. All patients were satisfied with the treatment outcome. As the postoperative time increased the progressive adaptation of graft edges to the surrounding tissues and increased morphologic and chromatic resemblance was observed. After 6 months, a complete reduction in recession depth and recession width was noticed in the most cases (Table 2,4).

We excluded one case because oral health standards were not available.

### The length recession:

The decrease in the length recession of the first class was high at the beginning of the treatment phase. The decrease was 94.4% after one month of treatment. However, the reduction rate reached 85.9% at the end of the treatment period. While the decline was less in the second class recession starting from the third month to 82% and continued until the end of the treatment phase as shown in Table (2).

**Table 1:-**Descriptive statistics of the mean values of the depth of the recession, (mm) according to the gingival recession class and the treatment time.

treatment time	classification of recession	number of cases	The minimum value for the depth of the recession	the maximum value for the depth of the recession	average depth of the recession	standard deviation
Before	Class 1	10	1	3	1.77	.660
	Class 2	9	1.5	3.0	2.17	.4330
After 1 month	Class 1	10	0	1	.100	.320
	Class 2	9	0	1.0	.330	.50
After 3 months	Class 1	10	0	1	.200	.420
	Class 2	9	0	1.5	.390	.600
After 6 months	Class 1	10	0	1	.250	.420
	Class 2	9	0	1.5	.390	.650

**Table 2:-**Percentage of decline the gingival recession depth according to the recession category and the treatment stages.

follow up	class 1	class 2
After 1 month	-94.4%	-84.8%
After 3 months	-88.7%	-82%
After 6 months	-85.9%	-82%

**The width recession :**

A rapid decrease in the average width of the gingival recession and for the two recession classes during the treatment stages. The decrease in the first class after 6 months was 0.45 mm and 0.56 mm in the second class. The decline in gingival recession was slightly higher in the first class, with 85.7% reduction after 3 months of treatment and maintaining a decline after 6 months. The decline in the second class was 75.8% after 3 months of treatment and 82.6 after 6 months of treatment Table (4)

**Table 3:-**Descriptive statistics of the mean values of the width of the recession, (mm) according to the gingival recession class and the treatment time.

TREATMENT TIME	CLASSIFICATION OF RECESSION	NUMBER OF CASES	THE MINIMUM VALUE FOR THE width OF the RECESSION	THE MAXIMUM VALUE FOR THE width OF the RECESSION	AVERAGE width OF THE RECESSION	STANDARD DEVIATION
before	Class 1	10	2	4.5	3.15	.850
	Class 2	9	2	5.0	3.22	.940
After 1 month	Class 1	10	0	3	.300	.950
	Class 2	9	0	3	.780	1.20
After 3 months	Class 1	10	0	3	.450	1.01
	Class 2	9	0	3	.780	1.20
After 6 months	Class 1	10	0	3	.450	1.0
	Class 2	9	0	3	.560	1.1

**Table 4:-**Percentage of decline the gingival recession width according to the recession category and the treatment stages.

follow up	class 1	class 2
After 1 month	-90.5%	-75.8%
After 3 months	-85.7%	-75.8%
After 6 months	-85.7%	-82.6%

**Discussion:-**

Several surgical techniques have been developed to correct the gingival recession defects, but they have failed to provide predictable and satisfactory results to the patients. The purposes of developing new techniques are to increase predictability and to reduce patient's discomfort, number of surgeries and the number of surgical sites, together with the need to satisfy the patient's esthetic demands, which include the final color and a tissue blend of the grafted area<sup>16</sup>. The goals for surgical treatment of gingival recession include reducing root sensitivity, minimizing cervical root caries, increasing the zone of attached gingiva and improving esthetics.

The ideal and most important requirement of graft is that it should have its own blood supply and the potential for promoting the regeneration of lost periodontal structures. The adult human periosteum is highly vascular and is known to contain fibroblasts and their progenitor cells and stem cells. The cells of the periosteum retain the ability to differentiate into fibroblasts, osteoblasts, chondrocytes, adipocytes and skeletal myocytes throughout life. The tissues produced by these cells include cementum with the periodontal ligament fibers and bone.<sup>17</sup> Due to its osteogenic potential and presence adjacent to gingival recession defects in sufficient amounts, makes periosteum suitable for a graft. The adult human periosteum is highly vascular and comprises of at least two layers, an inner

cellular layer or cambium layer and outer fibrous layer<sup>18,19,20</sup> Due to the osteogenic potentiality of periosteum, it has been considered as a grafting material for the repair of bone and joint defects.

When the periosteum is inverted on the surface of the root, the fibrous layer becomes towards the root surface and increases the probability of a new attachment covering the recession. Only few limited studies are available in literatures that have mentioned the use of periosteum for the treatment of gingival recession defects successfully. Mahajan and Harshavardhana **et al.** have reported the successful treatment outcome by using the periosteal pedicle graft for treating gingival recession defects<sup>21,22,23</sup>. Lekovic **et al.** and Kwan **et al.** used periosteum as a barrier membrane for the treatment of periodontal defects in their studies<sup>24,25,26</sup>. A recent study reported that periosteal cells release a vascular endothelial growth factor.<sup>27</sup> According to LoMelcher, such periosteal activation may result in the differentiation of cells portraying the ability to produce cementum and connective tissue and may lead to enhanced cementogenesis and fiber reattachment to tooth structure, demineralized **in situ**.<sup>27</sup> An increase in gingival height independent of the number of millimeters is considered a successful outcome of gingival augmentation procedures.<sup>28</sup> Histologic studies carried out by Wilderman and Wentz have shown connective tissue attachment of the replaced tissues to previously denuded root surfaces.<sup>29</sup> Thus, it seems obvious that some kind of connective tissue reattachment is a possibility with the osteostimulated repositioned periosteal flap. The success of the technique may be due to the high vascularity of the graft, the single surgical site, patient comfort, reduced intraoperative time and minimum postoperative complications and the low cost of treatment.

### Conclusion:-

The periosteal inverted graft has come up as a viable treatment option for the treatment of GRD with a great possibility to regenerate the lost periodontal tissues and form a new attachment at the treated gingival recession site.

Future studies with long-term follow-ups and histological evidence regarding the healing of periosteal graft are suggested to make this technique as an established procedure for the treatment of GRD

The advantages of periosteal inverted graft are:

1. The periosteal inverted graft does not require a second surgical site to obtain a donor tissue.
2. Vestibular deepening and root coverage are in a single procedure.
3. Sufficient amount of tissue can be obtained from adjacent to the defect.
4. Dual blood supply to the periosteum.
5. Less surgical trauma.
6. Less postoperative complications.
7. Better patient satisfaction.

Thus, it can be concluded that a periosteal inverted graft, when combined with a fenestration technique for vestibular deepening, offers a successful and viable alternative for the coverage of localized gingival recessions with an inadequate width of attached gingiva.

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### References:-

1. The American Academy of Periodontology. *Glossary of Periodontal Terms*, 4th edition. Chicago: The American Academy of Periodontology; 2001:1-56
2. Loe H. In: Periodontal therapy. 4. Goldman HM, Cohen HW, editors. St. Louis: Mosby; 1968. [Google Scholar]
3. Newman MG, Takei H, Klokkeveld PR, Carranza FA, editors. Carranza's clinical periodontology. 12th ed. St. Louis: Elsevier; 2014.
4. Cairo F, Pagliaro U, Nieri M. Treatment of gingival recession with coronally advanced flap procedures: A systematic review. *J Clin Periodontol.* 2008;35:136–62. [PubMed] [Google Scholar]
5. Wennström JL. Mucogingival therapy. *Ann Periodontol.* 1996;1:671–
6. Rasperini G, Acunzo R, Limiroli E. Decision making in Gingival Recession Treatment: Scientific Evidence and Clinical Experience. *Clinical Advances in Periodontics.* 2011;1:1. [DOI]

7. Maynard JG Jr. Coronal positioning of a previously placed autogenous gingival graft. *J Periodontol* 1977;48:151-5. Back to cited text no. 2
8. De Bari C, Dell'Accio F, Vanlauwe J, et al. Mesenchymal multipotency of adult human periosteal cells demonstrated by single-cell lineage analysis. *Arthritis Rheum* 2006;54:1209–1221.
9. Wiley Online Library CAS PubMed Web of Science@Google Scholar
10. Sakata Y, Ueno T, Kagawa T, et al. Osteogenic potential of cultured human periosteum-derived cells: a pilot study of human cell transplantation into a rat calvarial defect model. *J Craniomaxillofac Surg* 2006;34:461–465
11. Mahajan A. Periosteal pedicle graft for the treatment of gingival recession defects: A novel technique. *Aust Dent J.* 2009;54:250–4. [PubMed]
12. Mahajan A. Treatment of multiple gingival recession defects using periosteal pedicle graft: a case series. *J Periodontol.* 2010;81:1426-1431. [PubMed] [DOI]
13. Mahajan A, Bharadwaj A, Mahajan P. Comparison of periosteal pedicle graft and subepithelial connective tissue graft for the treatment of gingival recession defects. *Aust Dent J.* 2012;57:51-57. [PubMed] [DOI]
14. Duval BT, Maynard JG, Gunsolley JC, Waldrop TC. Treatment of human mucogingival defects utilizing a bioabsorbable membrane with and without a demineralized freeze-dried bone allograft. *J Periodontol.* 2000;71:1687–92. [PubMed] [Google Scholar]
15. Esteves J, Bhat KM, Thomas B, Varghese JM, Jadhav T. Efficacy of human chorion membrane allograft for recession coverage: A case series. *J Periodontol.* 2015;86:941–4. [PubMed] [Google Scholar]
16. Kimble KM, Eber RM, Soehren S, Shyr Y, Wang HL. Treatment of gingival recession using a collagen membrane with or without the use of demineralized freeze-dried bone allograft for space maintenance. *J Periodontol.* 2004;75:210–20. [PubMed] [Google Scholar]
17. Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: Root coverage revisited. *Periodontol* 2000. 2001;27:97–120. [PubMed] [Google Scholar]
18. Greenwell H, Fiorellini J, Giannobile W, Offenbacher S, Salkin L, Townsend C, et al. Oral reconstructive and corrective considerations in periodontal therapy. *J Periodontol.* 2005;76:1588–600.[PubMed] [Google Scholar]
19. Bhaskar SN. 11th ed. St. Louis: Mosby; 2002. *Orbans™ Histology and Embryology*; p. 209. [Google Scholar]
20. Simon TM, Van Sickle DC, Kunishima DH, Jackson DW. Cambium cell stimulation from surgical release of the periosteum. *J Orthop Res.* 2003;21:470–80. [PubMed] [Google Scholar]
21. Youn I, Suh JK, Nauman EA, Jones DG. Differential phenotypic characteristics of heterogeneous cell population in the rabbit periosteum. *Acta Orthop.* 2005;76:442–50. [PubMed] [Google Scholar]
22. Mahajan A. Periosteal pedicle graft for the treatment of gingival recession defects: A novel technique. *Aust Dent J.* 2009;54:250–4. [PubMed] [Google Scholar]
23. Mahajan A. Treatment of multiple gingival recession defects using periosteal pedicle graft: A case series. *J Periodontol.* 2010;81:1426–31. [PubMed] [Google Scholar]
24. Harshavardhana B, Rath SK, Mukherjee M. Periosteal pedicle graft – A new modality for coverage of multiple gingival recession defects. *Indian J Dent Adv.* 2013;5:1139–42. [Google Scholar]
25. Lekovic V, Kenney EB, Carranza FA, Martignoni M. The use of autogenous periosteal grafts as barriers for the treatment of Class II furcation involvements in lower molars. *J Periodontol.* 1991;62:775–80.[PubMed] [Google Scholar]
26. Lekovic V, Klokkevold PR, Camargo PM, Kenney EB, Nedic M, Weinlaender M. Evaluation of periosteal membranes and coronally positioned flaps in the treatment of Class II furcation defects: A comparative clinical study in humans. *J Periodontol.* 1998;69:1050–5. [PubMed] [Google Scholar]
27. Kwan SK, Lekovic V, Camargo PM, Klokkevold PR, Kenney EB, Nedic M, et al. The use of autogenous periosteal grafts as barriers for the treatment of intrabony defects in humans. *J Periodontol.* 1998;69:1203–9. [PubMed] [Google Scholar]
28. Melcher AH. On the repair potential of periodontal tissues. *J Periodontol.* 1976;47:256–60. [PubMed] [Google Scholar]
29. Wennström JL, Zucchelli G. Increased gingival dimensions. A significant factor for successful outcome of root coverage procedures? A 2-year prospective clinical study. *J Clin Periodontol.* 1996;23:770–7.[PubMed] [Google Scholar]
30. Wilderman MN, Wentz FM. Repair of a dentogingival defect with a pedicle flap. *J Periodontol.* 1965;36:218–[PubMed] [Google Scholar].