

CASE REPORT

ROOT COVERAGE WITH PERIOSTEUM PEDICLE GRAFT – A NOVEL APPROACH

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ABSTRACT :

Aim : To cover root surface with periosteum pedicle graft.

Methods : A patient with miller class I recession i.r.t 31, 32 and 33, with probing depth of 2.5mm and clinical attachment loss of 4mm i.r.t 31, 32 and 33 and class III gingival recession i.r.t 41 and 43 was treated using periosteum pedicle graft. 42 was missing. Periosteum was dissected and increased in length coronally to cover the root surface. After stabilizing the periosteal graft with sutures, the epithelium was positioned over it and sutured.

Result : Uneventful healing of the operated site was observed after 1 month. There was full coverage of the gingival recession with satisfactory results. There was an increase in morphologic and chromatic resemblance with the adjacent area.

Conclusion : Periosteum can be successfully used for the treatment of multiple gingival recession defects.

Key words : gingival recession, osteogenic properties, periosteum.

Introduction:

Gingival recession is a common problem affecting 40-90% of population¹ leading to poor esthetics, root caries, erosion and dental hypersensitivity and to address these problems various techniques have been developed to achieve root coverage. There is always a need of developing newer procedures for root coverage and the use of various grafts and tissue engineering techniques including stem cell research are testimony to the ever increasing need for most suitable treatment option to replace/repair lost tissues to various pathologic processes³. One such successful root coverage procedure is the periosteum pedicle graft.

Periosteum is a highly vascular connective tissue sheath covering the external surface of all the bones except for sites of articulation and muscle attachment⁴. The periosteum comprises of at least two layers, an inner cellular or cambium layer and an outer fibrous layer⁵. The inner layer contains numerous osteoblasts and osteoprogenitor cells, and the outer layer is composed of dense collagen fiber, fibroblasts and their progenitor cells⁶.

Periosteum-derived progenitor cells have the ability to proliferate rapidly and capability to differentiate into multiple mesenchymal lineages³. Cells residing within periosteum may be excised from any surgically accessible bone surfaces. When properly stimulated, these acts as a bioreactor supporting a dramatic increase in the progenitor cell population over the course of a few days³.

Duhamel was the first investigator to study the osteogenic potential of periosteum⁸. Ollier⁹ proved that periosteum produces bone and his study was reinforced by Axhausen¹⁰. Hey groves¹¹ in his detailed study concluded that periosteum is osteogenic, but only if elevated by sharp dissection, with preservation of a middle or cambium layer lying between bone and periosteum. Trueta and Cavadias¹² observed that proliferation of the periosteal blood vessels was followed by new bone formation in the subperiosteal region. According to Zucman, Maurer and Berbeson¹³ periosteal cells retain osteogenic potential even though temporarily

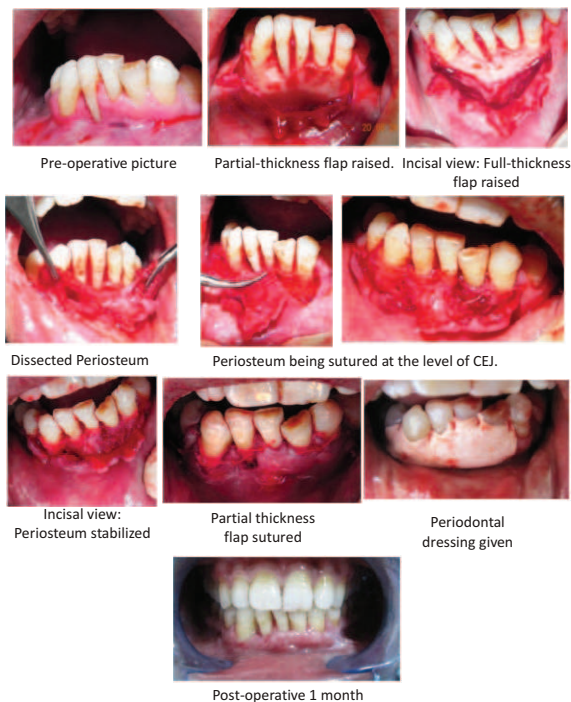
devascularised. Skoog¹⁴ raised periosteal flaps from the palatal surface of maxilla to obtain bony closure of palatal defects in children. These flaps were raised by sharp dissection and published results strongly supported osteogenic properties of well vascularised periosteum within 3–6 months following surgery. Since then many investigators have utilized osteogenic property of periosteum for cell culture and root coverage procedures.

Case description:

A 30 years old male patient, reported with unesthetic problems in lower anteriors. On presurgical intraoral examination, gingival status was normal except i.r.t 31,33. There was miller class I recession i.r.t 31, 32 and 33, with probing depth of 2.5mm and clinical attachment loss of 4mm i.r.t 31, 32 and 33. There was class III gingival recession i.r.t 41 and 43. 42 was missing. Patient was willing for the treatment of the defect and an informed consent was taken for the same.

At the start of surgical procedure patients was given local anesthesia with a solution of 2% lignocaine with 1:200000 adrenaline. An intra- crevicular incision was given from 33-43 and vertical incision was given beyond the mucogingival junction to release the flap. A Full-thickness flap was raised, double the amount of recession to be covered. This full-thickness flap was then pulled buccally to create tension on the periosteum. An incision was made at the base of the periosteum, it was dissected and lifted slowly in a coronal direction and was brought till the CEJ. The exposed root surface was covered with periosteum and sutured with 4-0 vicryl sutures using sling suture technique. After stabilizing the periosteal graft, the flap was coronally positioned and sutured. The releasing incisions were closed with interrupted sutures after which the operated site was covered with non-eugenol periodontal dressing for protection.

Post-operatively the patient was prescribed amoxicillin 500 mg TDS for 5 days, Ibuprofen 400 mg thrice daily for 3 days and 0.2% chlorhexidine mouthwash for 2 weeks. Postoperative instruction and oral hygiene instructions were given to the patient. After 1 week, the periodontal dressing and sutures were removed and patient was asked to maintain strict oral hygiene with periodic check-ups every month.



Result: Patient reported after 1 week, intraoral post-operative checkup revealed uneventful healing of the operated site, full coverage of the gingival recession and satisfactory results. At 1 month postoperative check up there was satisfactory root coverage and an increase in morphologic and chromatic resemblance with the adjacent area.

Discussion:

The regeneration of the tooth supporting structures which have been lost as a consequence of periodontal disease has become an 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 predictable¹⁵. Inherent problems of a limited quantity of available graft, the need for two surgical sites, compromised patient esthetics, postoperative discomfort and complications, and increased costs of treatment have limited the success of one single universal technique that can be used with high predictability, effectiveness, and efficiency without compromising patient

centered criteria like pain, postoperative esthetic outcomes, and costs of treatment¹⁶. Research has shown that periosteum is rich in osteogenic cells. According to Simon¹⁷ and Bhaskar¹⁸, the inner layer of periosteum contains numerous osteoblasts and osteoprogenitor cells and the outer layer contains dense collagen fiber and fibroblasts and their progenitor cells making periosteum a highly regenerative tissue. According to Bouchard et al¹⁹ tissues produced by these cells include cementum with periodontal ligament fibers and bone²⁰, making it an ideal graft material in cases of recession and bone loss. In a recent in-vitro study by Kawase et al²¹, cultured periosteum cells on HA (hydroxyapatite) block demonstrated that an osteogenic tissue engineered bone substitute could be prepared by periosteal cells, which have regenerative capacity.

According to Mahajan¹⁶ results were highly encouraging when periosteum pedicle graft was used to cover recession defects which showed reduction to 0.3 –0.57 mm from 3.75 –1.55, also there was a gain in widths of keratinized and attached gingiva, however he used partial thickness flap which has the disadvantage of loss of radicular bone, which is amplified in thin gingival biotype, also if partial dissection of this biotype is done it leads to compromised blood supply and eventual flap death or recession²². Claffey and Shanley²³ reported that subjects with gingiva <1.5 mm thick at a mid-buccal location lost attachment after supra- and sub-gingival debridement. No sites with mucosa >2mm receded. A study on pedicle flaps in pigs demonstrated that subjectively thick flaps survived twice as often as thin flaps (55.7% versus 26.5%) and that thin flaps relied mostly on collateral circulation from the recipient bed for oxygen and nutrients²⁴. In our technique we have raised a full thickness flap which eliminates these disadvantages in cases with thin gingival biotype.

The wound healing after surgery requires rich blood supply, revascularization and maintenance of blood supply for reattachment to take place. Also, a vascular graft has more chances of surviving on an avascular root surface¹⁶. According to a study by Bourke²⁵ periosteal cells release vascular endothelial growth factors; such properties make the periosteum suitable graft over an avascular root surface. Also as it is a pedicle graft, it retains the blood supply maintaining vascularity. The advantage of using periosteum graft is that its patient's own tissue and there is no chance of infection or reaction. It is affordable and second surgical site is not required, also a larger area can be grafted using patient's own tissue. This technique has minimal intraoperative time and minimum postoperative complications.

This technique is better as compared to other

techniques used for root coverage such as the use of alloderm, as it has chances of reaction and is an expensive treatment. Palatal connective tissue grafting technique is sensitive and gives the patient two surgical sites in the mouth, making eating, swallowing and speaking difficult. Also, a small amount of tissue can be harvested which sometimes is not enough with huge defects.

The only disadvantage of this technique is that it requires a skilled operator, also long-term results of this technique are yet to be assessed, however, healing in case of periosteal graft gives satisfactory results.

Conclusion

Periosteum can be successfully used for the treatment of multiple gingival recession defects. However, further research and clinical assessment is needed with respect to this technique. Also, long term results of periosteum graft are lacking, which also need further research.

References

- Lang NP, Loe H. The relationship between the width of keratinized gingival health. *J Periodontol* 1972;43:623-27.
- Kumar ABT, Mehta DS. Comparative evaluation of subepithelial connective tissue graft (SCTG) and acellular dermal matrix allograft (ADMA) in the treatment of localized gingival recession-a clinical study. *J Int Clin Dent Res Org* 2009;1:8-16.
- Mahajan A. Periosteum: A Highly Underrated Tool in Dentistry. *Int J Dent*, 2011;2012:1-6.
- Provenza DV, Seibel W. Basic Tissues, Oral Histology Inheritance and Development, Lea and Feibger, 2nd edition, 1986.
- Finley JM, Acland RD, Wood MB. Revascularized periosteal grafts. A new method to produce functional new bone without bone grafting," *Plastic and Reconstructive Surgery*, vol. 61, no. 1, pp. 1-6, 1978.
- Orban B J, Bhaskar SN. Orban's Oral Histology and Embryology, 11th edition, 2002.
- Arnsdorf EJ, Jones LM, Carter DR, Jacobs CR. The periosteum as a cellular source for functional tissue engineering. *Tissue Engineering* 2009;15:2637-2642.
- Hutmacher DW, Sittinger M. Periosteal cells in bone tissue engineering, *Tissue Engineering*, 2003; 9 (supp):S45-S64.
- Oilier L. Traite experimental et clinique de la regeneration des os et de la production artificielle do tissu osseu.v. 2 vols. Paris : Victor Masson et Fils
- Axhausen G. Die histologischen und klinischen Gesetze der freien Osteoplastik aufGrund von Thierversuchen. *Archiv fur klinische Chirurgie*, 88, 23-145.
- Groves E. W. H. Methods and results of transplantation of bone in the repair of defects caused by injury or disease. *British Journal of Surgery*, 5, 185-242.
- Trueta J., Cavadias A. X. Vascular changes caused by the Kuntscher type of nailing. *Journal of Bone and Joint Surgery*, 37-B, 492-505.
- Zucman J, Maurer P, Berbesson C. The effect of autografts of bone and periosteum in recent diaphysial fractures. *J Bone Joint Surg* 1968;50:409-422.
- Skoog T. The use of periosteal flaps in the repair of clefts of the primary palate. *Cleft Palate J* 1965; 2:332-339.
- Position Paper. Periodontal Regeneration. *J Periodontol* 2005;76:1601-1622.
- Mahajan A. Treatment of Multiple Gingival Recession Defects Using Periosteal Pedicle Graft: A Case Series. *J Periodontol* 2010;81:1426-1431.
- Simon TM, Van Sickle DC, Kunishima DH, Jackson DW. Cambium cell stimulation from surgical release of theperiosteum. *JOrthopRes* 2003;21:470-480
- BhaskarSN. In: BhaskarSN, ed. *Orban's Oral Histology and Embryology*, 11th ed. New Delhi: Harcourt India Private Ltd.; 1991:209.
- Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: Root coverage revisited. *Periodontol* 2000 2001;27:97-120.
- 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.
- Kawase T, Okuda K, Kogami H, Nakayama H, Nagata M, Sato T, Wolff LF, Yoshie H. human Periosteum-derived cells combined with superporous hydroxyapatite block used as an osteogenic bone substitute for periodontal regenerative therapy: an animal implantation study using nude mice. *J periodontol* 2010;81:420-427.
- Hwang D, Wang HL. Flap Thickness as a Predictor of Root Coverage: A Systematic Review. *J Periodontol* 2006;77:1625-1634.
- Claffey N, Shanley D. Relationship of gingival thickness and bleeding to loss of probing attachment in shallow sites following nonsurgical periodontal therapy. *J Clin Periodontol* 1986;13:654-657.
- Clodius L, Smahel J. Thin and thick pedicle flap. *Acta Chir Plast* 1972;14:30-35.
- Bourke HE, Sandison A, Hughes SP, Reichert IL. Vascular endothelial growth factor (VEGF) in human periosteum – Normal expression and response to fracture. *J Bone Joint Surg Br* 2003;85-B(Suppl):4.