

New perspectives on the contentions and contemporary role of sub-epithelial Connective tissue graft

Karthikeyan BV^{1*}, Kamedh Yashawant Chowdhary², Divya Khanna³, Prabhuji MLV⁴

¹⁻³Reader, ⁴Professor, Dept. of Periodontics, Krishnadevaraya College of Dental Sciences & Hospital, Bangalore, Karnataka, India

***Corresponding Author: Karthikeyan BV**

Email: drkarthikeyanbv@gmail.com

Abstract

Periodontal plastic surgery in aesthetically demanding zone has always posed a challenge to the clinician due to high expectations on part of the patient. In spite of array of advancements in the field of material science and regenerative techniques, predictable results are still far from reality. Among the regenerative materials, sub-epithelial connective tissue graft has stood the test of time in periodontal aesthetic surgeries. Nevertheless, with the better understanding of connective tissue graft some contentious issues regarding its application have been raised and clinicians should be aware of these issues before its practical implication. This commentary will shed light on such controversial issues and explore some of the recent advances in the utilization of connective tissue graft in interdisciplinary dental care.

Keywords: Sub- epithelial Connective tissue, Perio plastic surgery, Root coverage, Regeneration, Esthetic surgeries.

Introduction

The passion of periodontal plastic surgeons and aesthetic demand of the patient has become a paramount concern in dentistry.¹ This has been a driving force for the researchers to develop new materials and methods, yet predictable aesthetic outcome remains an enigma.² Although, various materials have been introduced for periodontal regeneration,³⁻⁷ literature evidences suggest that an autogenous connective tissue graft (CTG) can be regarded as the most reliable material which provides the best aesthetic outcome and is therefore considered as gold standard.⁸ In spite of this large documented evidence on the utilisation of CTG in periodontal plastic surgery, it is no bar from controversies (method of application,³ type of attachment,⁹⁻¹¹ size of graft¹² etc.). Despite these controversies some clinical situations warrant usage of connective tissue grafting. Hence, it is mandatory to know the various aspects of connective tissue graft with its realities and limitations. The objective of this commentary is to update the reader on the several facets of contentions of connective tissue grafting with its versatile applications in the interdisciplinary dental care.

Contentions of the Connective Tissue Graft Epithelial Collar

Some authors advocate leaving a part of epithelium on the CTG³ while others have opined against it.¹³ Idea behind leaving a small portion of epithelium was allowing for the smooth transition from the donor to recipient dentition, a better colour match, increases keratinized tissue and also aids in suturing and rapid healing.

However, some researchers have found that, it causes gingival surgical cysts, did not provide a smooth junction (demarcation line between existing flap and graft), which later required gingivoplasty. Since connective tissue carries the potential to induce keratinisation an increase in gingival width occurs in either case as long as connective tissue part of the graft survives. Further, it is advocated that better graft stabilization can be achieved by removal of collar.¹⁴ Based

on this various methods have been advised which either include or exclude epithelium.

Table 1: Techniques for harvesting tissue

With epithelium	Without epithelium
1. Langer & Calagna (1980) ¹⁵	1. Edel (1974)- Trap Door Technique ²⁰
2. Langer & Langer (1985) ³	2. Harris (1992)- Graft Knife Technique/ Harris Double Blade Technique ⁵
3. Raetzke (1985) ¹²	3. Single Incision Techniques
4. Bruno (1994)- Double Incision Technique ¹⁶	a. Hürzeler & Weng (1999) ²¹
5. Hirsch et al (2001) ¹⁷	b. Lorenzana & Allen (2000) ²²
6. Ribeiro (2008) ¹⁸	c. Del Pizzo et al. (2002) ²³
7. Bosco & Bosco (2007) ¹⁹	4. McLeod (2009) ²⁴

A recent study had been carried out to determine the significance of epithelial collar on the sub epithelial CTG. In this study SCTG with or without epithelial collar was combined with coronally advanced flap. This study proved that both SCTG techniques provided predictable and successful root coverage indicating that retained epithelial collar does not play a significant role towards the healing of SCTG.²⁵

Connective Tissue Graft Size

For the graft survival it is necessary that the graft extends laterally and apically beyond the area of recession and lie on the sound bone. This thought is to provide enough blood supply to nourish the uncovered portion of the graft over the denuded root.

There were contentions on the graft size. Allen advised 3-5mm extension. Raetzke (1985) suggested flap should cover atleast half of the graft.¹² Researchers have suggested that the size of the graft tissue should be at least 11 times greater than visible denuded area.²⁶

Thick versus Thin Connective Tissue Graft

Recent studies have shown that in about 80% of grafts some amount of epithelium remains hence CTG should be called as “predominantly connective tissue grafts”. Mean depth of lamina propria is found to be 3.2mm which makes up approximately 65.2% of graft. Depth of sub mucosa was found to be 2mm i.e. 34.8% of the graft thickness. Previous studies by Sullivan and Atkins have reported thickness of lamina propria in the range of 1.25-1.75mm.²⁷ On the other hand, study by Harris RJ (2003) has shown that this thickness is around 3.25mm that is significantly larger than previous studies. Sub mucosa is always present apical to the lamina propria hence dissecting the larger graft will only increase the thickness of sub mucosa rather than increasing lamina propria.²⁸

Further, it has been recently demonstrated that smaller thinner connective tissue grafts work as well as larger thicker CTG when the graft is completely covered by coronally repositioned flap. However, further studies are required to confirm long term stability of thick versus thin CTG.^{29,30}

Connective Tissue versus Epithelial Attachment

Several studies have been carried out to assess the type of attachment with SCTG to the root surface and have given diverse results. Weng et al (1998) reported a gain of mean attachment of 57% with formation new bone and cementum.⁹ Bruno & Bowers (2000) noted that connective tissue was in intimate contact with the dentinal surface and suggested attachment type as of ‘connective tissue adhesion’.¹⁰ Goldstein et al (2001) suggested the evidence of new connective tissue attachment formation including periodontal ligament.¹¹ Majzoub et al (2001) concluded that CTG shows minimal signs of cementum like tissue formation with minimal bone resorption and ankylosis and healing seen was with long junctional epithelium.³¹ Later, Guiha R (2001) said that attachment of the graft to the root surface appears to be mediated by formation of epithelial downgrowth with connective tissue attachment with a little potential for new cementum & new bone formation.³²

It could be speculated that potential for some regeneration of new attachment apparatus exist following sub epithelial CTG. However, it could be because of many variables like mode of harvesting technique inclusion or exclusion of periosteum, root surface treatment etc. Therefore, further comparative studies are necessary before a definitive conclusion can be drawn regarding the nature of attachment.

Time frame for re-harvestment of CTG

Sometimes due to anatomical constraints CTG needs to be harvested multiple times from same area. In a study carried out to determine the length of time between two harvesting incidents it was noted that complete re-epithelisation takes place in 6.9-7.7 weeks. However, remodelling of the entire wound took about 9 weeks and beyond. Hence, it was suggested that to harvest a thick, dense lamina propria with interlacing bundles of collagen, minimum 9 week period is

necessary between two procurements, using double bladed scalpel.³³ In a different study, it was noticed that minimum time period for harvesting the CTG from the same anatomic area should be atleast 6 weeks. The 6 week interval has showed predictable outcomes without any probing defect or significant outcome when single incision technique is used.³⁴

Modified facets of CTG Application

Various modified aspects of CTG have been used over the period. These are;

Surgical Maneuvers for graft extension for multiple teeth recession coverage

Expanded Mesh Technique

Major limiting factor associated with autogenous CTG is the unavailability of large donor tissues. Further, in case of deep narrow palate the amount of tissue harvested becomes even less requiring more than one surgical procedure. To counter this problem the expanded mesh technique was proposed by Cetiner et al (2004). In this technique donor tissue alternating incisions are made on each edge of CTG to expand the ‘mesh’ graft. This graft can cover the recipient site which is approximately 1.5 times larger than the graft i.e. 50% expansion. It can be used to increase the width of keratinized tissue or for root coverage.³⁵

Split Connective Tissue Graft Technique

Ribeiro et al (2008) proposed a surgical manoeuvre to enlarge the extensions of the graft. To summarize briefly, the graft with maximum thickness is harvested from the palate and positioned on a sterile glass plate and immobilized with a sterile wooden spatula. The graft is split cross-sectionally with a number 15 scalpel blade. However, it is not divided completely in two parts, which gave the graft almost twice the length of the initial graft and a thickness of ≈ 1.5 mm. Limitation of this approach is requirement of thick and intact graft.¹⁸

Frozen SCTG

Goggins & Gibbons first introduced the concept of freezing gingiva. They also suggested that the same graft can retain its vitality over the period of time.³⁶ Later Korman et al proved that basal cells and fibroblasts remain morphologically intact even if the free gingival graft is frozen. This aspect of free gingival graft is responsible for the success of frozen grafts.³⁷

Soileau and colleagues assessed the efficacy of frozen CTG utilizing the same concept given by Goggins & Gibbons. The SCTG was collected from the under-surface of the palatal flap and stored at 20°– 25°F for 5 weeks up to ten months in a sterile saline solution in a general use freezer. Tissues were later thawed and used for root coverage. This study has provided with comparable results and can be a predictable technique for in the treatment of mucogingival problems.³⁸

Combination of SCTG with PRP

Evidence has shown that PRP increases the efficacy of periodontal plastic surgery by suppressing epithelial cell division and stimulates the differentiation of cells from PDL to cementoblasts favouring new connective tissue attachment to root surface. Further, PRP can stimulate. However, recent consensus report by the researchers Suaid (2008) & systematic review presented by Del Fabbro (2011) concluded that there is no statistically significant difference for coverage but it did increase the width of keratinized gingival and accelerate the wound healing.^{39,40} It also increases the attachment level and reduces gingival recession.⁴¹

Combination of SCTG with Emdogain

Harris (1999) and Bruno (2000) reported that most of the clinical attachment attained with CTG is by adhesion of dense collagen fibres running parallel to the surface without new cementum or presence of Sharpey's fibres with areas of root resorption rather than true regeneration.^{10,42} To overcome this, some of the researchers advocated that true periodontal regeneration can be obtained by topical application of emdogain which aid in healing by formation of new cementum and new bone formation and further inhibiting the differentiation and proliferation of cementoclasts & osteoclasts to Prevents root resorption.^{10,42-44}

Question of long-term stability of clinical results observed with CT adhesion versus long junction epithelium versus CT attachment has to be determined.

Double Layer Connective Tissue Graft Technique

In case of gingival recession associated with deep coronaradicular abrasions surgical strategy can be applied to treat this problem completely without using mechanical technique such as grinding of the abrasion of CEJ to prevent dead tracts underneath.⁴⁵ Piniprato (2004) suggested the idea of using two CTGs to compensate for severe abrasion. First graft is positioned on the abrasion without extending laterally and suturing. This is followed by second graft positioned on the top of the first and is extended laterally to reach adjacent CT. This graft is then sutured to the periodontium.⁴⁶

Root coverage of Previously Carious Tooth

Use of CTG for root coverage after caries or restorations was reported in 1994.¹⁶ Recent studies by Goldstein has shown the effectiveness of root coverage by SCTG on root caries was very high ranging from 92-97%.⁴⁷ It was concluded that when gingival recession occurs due to root caries especially in the aesthetic zone, use of SCTG should be considered since this procedure unlike conventional restorative techniques resolves the problem in the biological manner.

Connective Tissue Grafting on Resin Ionomers

In cases of complex situation like gingival recession associated with root caries or root resorption a combined approach of restorative and periodontal treatment has to be

undertaken. In a histological study by Drago (1997), it has been demonstrated that both epithelium and connective tissue can adhere to the resin ionomers when placed in subgingival environment.⁴⁸ In addition, a study by Harris (2000) has shown successful use of SCTG over a glass ionomers restored root surface in the treatment of cracked tooth.⁴⁹ Recently, a case report by Alkan (2006) has shown a successful root coverage using SCTG on a glass ionomers restored root surface proving connective tissue attachment to the glass ionomers is a very predictable procedure with result that are similar to those found on intact roots.⁵⁰

Conclusion

CTG has proven its efficacy time and again compared to other regenerative techniques. However, in spite of the clinical advances, lacunae exist about the understanding of the CTG which leads to several unanswered questions; like, is there a similarity between the phenotype of gingival connective tissue and palatal connective tissue? Does gingival CT exert its influence on palatal CT when augmented? What is the effect of this combination (Gingival & Palatal CT) on phenotype of the formed epithelium? Since clinical benefits of SCTG are proven beyond doubt, further comparative studies should be carried out to throw more light on the histological makeup and its influence on the recipient site. This understanding of the histologic influence will help the clinician to make the best out of this versatile tissue with a sound scientific base.

Conflict of Interest: None.

References

1. Bidra AS, Chapokas AR. Treatment planning challenges in the maxillary anterior region consequent to severe loss of buccal bone. *J Esthetic Restorative Dent* 2011;23:354-60.
2. Wang HL, Modarressi M, Fu JH. Utilizing collagen membranes for guided tissue regeneration-based root coverage. *Periodontol* 2012;59:140-57.
3. Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 1985;56:715-20.
4. Greenwell H. Position paper: Guidelines for periodontal therapy. *J Periodontol* 2001;72:1624-8.
5. Harris RJ. The connective tissue and partial thickness double pedicle graft: a predictable method of obtaining root coverage. *J Periodontol* 1992;63:477-86.
6. Rosetti EP, Marcantonio RA, Rossa C, Jr., Chaves ES, Goissis G, Marcantonio E, Jr. Treatment of gingival recession: comparative study between subepithelial connective tissue graft and guided tissue regeneration. *J Periodontol* 2000;71:1441-7.
7. Paolantonio M, di Murro C, Cattabriga A, Cattabriga M. Subpedicle connective tissue graft versus free gingival graft in the coverage of exposed root surfaces. A 5-year clinical study. *J Clin Periodontol* 1997;24:51-6.
8. Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: root coverage revisited. *Periodontol* 2000 2001;27:97-120.
9. Weng D, Hurzeler MB, Quinones CR, Pechstadt B, Mota L, Caffesse RG. Healing patterns in recession defects treated with ePTFE membranes and with free connective tissue grafts. A histologic and histometric study in the beagle dog. *J Clin Periodontol* 1998;25:238-45.

10. Bruno JF, Bowers GM. Histology of a human biopsy section following the placement of a subepithelial connective tissue graft. *Int J Periodontics Restorative Dent* 2000;20:225-31.
11. Goldstein M, Boyan BD, Cochran DL, Schwartz Z. Human histology of new attachment after root coverage using subepithelial connective tissue graft. *J Clin Periodontol* 2001;28:657-62.
12. Raetzke PB. Covering localized areas of root exposure employing the "envelope" technique. *J Periodontol* 1985;56:397-402.
13. Bouchard P, Etienne D, Ouhayoun JP, Nilveus R. Subepithelial connective tissue grafts in the treatment of gingival recessions. A comparative study of 2 procedures. *J Periodontol* 1994;65:929-36.
14. Breault LG, Billman MA, Lewis DM. Report of a gingival "surgical cyst" developing secondarily to a subepithelial connective tissue graft. *J Periodontol* 1997;68:392-5.
15. Langer B, Calagna L. The subepithelial connective tissue graft. *The Journal of prosthetic dentistry* 1980;44:363-7.
16. Bruno JF. Connective tissue graft technique assuring wide root coverage. *Int J Periodontics Restorative Dent* 1994;14:126-37.
17. Hirsch A, Attal U, Chai E, Goultshin J, Boyan BD, Schwartz Z. Root coverage and pocket reduction as combined surgical procedures. *J Periodontol* 2001;72:1572-9.
18. Ribeiro FS, Zandim DL, Pontes AE, Mantovani RV, Sampaio JE, Marcantonio E. Tunnel technique with a surgical maneuver to increase the graft extension: case report with a 3-year follow-up. *J Periodontol* 2008;79:753-8.
19. Bosco AF, Bosco JM. An alternative technique to the harvesting of a connective tissue graft from a thin palate: enhanced wound healing. *Int J Periodontics Restorative Dent* 2007;27:133-9.
20. Edel A. Clinical evaluation of free connective tissue grafts used to increase the width of keratinised gingiva. *J Clin Periodontol* 1974;1:185-96.
21. Hurzeler MB, Weng D. A single-incision technique to harvest subepithelial connective tissue grafts from the palate. *Int J Periodontics Restorative Dent* 1999;19:279-87.
22. Lorenzana ER, Allen EP. The single-incision palatal harvest technique: a strategy for esthetics and patient comfort. *Int J Periodontics Restorative Dent* 2000;20:297-305.
23. Del Pizzo M, Modica F, Bethaz N, Priotto P, Romagnoli R. The connective tissue graft: a comparative clinical evaluation of wound healing at the palatal donor site. A preliminary study. *J Clin Periodontol* 2002;29:848-54.
24. McLeod DE, Reyes E, Branch-Mays G. Treatment of multiple areas of gingival recession using a simple harvesting technique for autogenous connective tissue graft. *J Periodontol* 2009;80:1680-7.
25. Byun HY OT, Abuhussein HM, Yamashita J, Soehren SE, Wang HL. Significance of the Epithelial Collar on the Subepithelial Connective Tissue Graft. *J Periodontol* 2009;80:924-32.
26. Yotnuengnit P, Promsudthi A, Teparat T, Laohapand P, Yuwaprecha W. Relative connective tissue graft size affects root coverage treatment outcome in the envelope procedure. *J Periodontol* 2004;75:886-892.
27. Sullivan HC, Atkins JH. Free autogenous gingival grafts. I. Principles of successful grafting. *Periodontics* 1968;6:121-9.
28. Harris RJ. Histologic evaluation of connective tissue grafts in humans. *Int J Periodontics Restorative Dent* 2003;23:575-83.
29. Zucchelli G, Amore C, Sforzal NM, Montebugnoli L, De Sanctis M. Bilaminar techniques for the treatment of recession-type defects. A comparative clinical study. *J Clin Periodontol* 2003;30:862-70.
30. Greenwell H, Fiorellini J, Giannobile W. Oral reconstructive and corrective considerations in periodontal therapy. *J Periodontol* 2005;76:1588-1600.
31. Majzoub Z, Landi L, Grusovin MG, Cordioli G. Histology of connective tissue graft. A case report. *J Periodontol* 2001;72:1607-15.
32. Guiha R, el Khodeiry S, Mota L, Caffesse R. Histological evaluation of healing and revascularization of the subepithelial connective tissue graft. *J Periodontol* 2001;72:470-8.
33. Soileau KM, Brannon RB. A histologic evaluation of various stages of palatal healing following subepithelial connective tissue grafting procedures: a comparison of eight cases. *J Periodontol* 2006;77:1267-73.
34. Park JB. Root coverage with 2 connective tissue grafts obtained from the same location using a single-incision technique. *Quintessence Int* 2009;40:371-6.
35. Cetiner D, Bodur A, Uraz A. Expanded mesh connective tissue graft for the treatment of multiple gingival recessions. *J Periodontol* 2004;75:1167-72.
36. Goggins JF, Gibson WA. Histochemistry of viable frozen-stored human gingiva. *J Invest Dermatol* 1968;51:137-140.
37. Korman M, Rubinstein A, Gargiulo A. Preservation of palatal mucosa. I. Ultrastructural changes and freezing technique. *J Periodontol* 1973;44:464-9.
38. Soileau KM, Aydin BG, Davenport WD, Jr. Evaluation of frozen subepithelial connective tissue grafts to increase the zone of attached gingiva. Report of 5 cases. *J Periodontol* 2002;73:220-30.
39. Suaid FF, Carvalho MD, Santamaria MP, et al. Platelet-rich plasma and connective tissue grafts in the treatment of gingival recessions: a histometric study in dogs. *J Periodontol* 2008;79:888-95.
40. Del Fabbro M, Bortolin M, Taschieri S, Weinstein R. Is platelet concentrate advantageous for the surgical treatment of periodontal diseases? A systematic review and meta-analysis. *J Periodontol* 2011;82:1100-11.
41. Rocuzzo M, Bunino M, Needleman I, Sanz M. Periodontal plastic surgery for treatment of localized gingival recessions: A systematic review. *J Clin Periodontol* 2002;29:178-94.
42. Harris RJ. Successful root coverage: a human histologic evaluation of a case. *Int J Periodontics Restorative Dent* 1999;19:439-47.
43. Wennstrom JL, Lindhe J. Some effects of enamel matrix proteins on wound healing in the dento-gingival region. *J Clin Periodontol* 2002;29:9-14.
44. Carnio J, Camargo PM, Kenney EB, Schenk RK. Histological evaluation of 4 cases of root coverage following a connective tissue graft combined with an enamel matrix derivative preparation. *J Periodontol* 2002;73:1534-43.
45. Holbrook T, Ochsnein C. Complete coverage of the denuded root surface with a one-stage gingival graft. *Int J Periodontics Restorative Dent* 1983;3:8-27.
46. Pini-Prato G, Baldi C, Rotundo R, Franceschi D, Muzzi L. The Treatment of Gingival Recession Associated with Deep Corono-Radicular Abrasions (CEJ step) – a Case Series. *PERIO* 2004;1:57-66.
47. Goldstein M, Nasatzky E, Goultshin J, Boyan BD, Schwartz Z. Coverage of previously carious roots is as predictable a procedure as coverage of intact roots. *J Periodontol* 2002;73:1419-26.
48. Dragoo MR. Resin-ionomer and hybrid-ionomer cements: part II, human clinical and histologic wound healing responses in specific periodontal lesions. *Int J Periodontics Restorative Dent* 1997;17:75-87.
49. Harris RJ. Treatment of a cracked tooth with a resin-ionomer restoration and a connective tissue graft: a case report. *Int J Periodontics Restorative Dent* 2000;20:612-7.

50. Alkan A, Keskiner I, Yuzbasioglu E. Connective tissue grafting on resin ionomer in localized gingival recession. *J Periodontol* 2006;77:1446-51.

How to cite this article: Karhikeyan BV, Chowdhary KY, Khanna D, Prabhuji MLV. New perspectives on the contentions and contemporary role of sub-epithelial Connective tissue graft. *Int J Periodontol Implantol* 2019;4(2):35-9.