

Clinical Application of the Mucogingival Subepithelial Connective Tissue Graft

Eugene Kryshchalskyj, DDS, Dip. Perio, MSc, FRCD(C); Eugene Gerald Kryshchalskyj, BHS; Alexander Kryshchalskyj

INTRODUCTION

In 1999, Albandar et. al¹ estimated that more than 20 percent of the population presents with one or more tooth surfaces with gingival recession. When root exposure occurs, it can be quite uncomfortable causing root sensitivity and can lead to cosmetic and functional impairment. The treatment of gingival recession therefore is indicated for esthetic reasons, to reduce root sensitivity, and to restore the integrity of the keratinized tissue.² The treatment aims to improve esthetics, comfort and function.

ETIOLOGY OF GINGIVAL RECESSION³

Predisposing Factors:

1. Inadequate attached gingiva (thin biotype)
2. A high frenum attachment
3. Malposition of teeth (prominent roots)
4. Osseous dehiscence/fenestrations

Of all of these factors, the most critical is the width of attached gingiva. Gingival recession is unlikely to occur if the attached

gingiva is adequate and the contributing factors are controlled.³

Contributing Factors:³

1. Vigorous tooth brushing, especially with stiffer brushes and most power brushes
2. Bruxism causing abfraction lesions
3. Laceration (chronic direct trauma to the marginal gingiva which may include hard crusty foods like toast and crusty rolls)
4. Gingival inflammation secondary to poor plaque control
5. Iatrogenic factors (Figs. 1-3)

Iatrogenic factors include:

1. Restorative procedures extending subgingivally in areas of inadequate attached gingiva
2. Subgingival placement of rubber dam clamp – direct trauma
3. Close apposition and direct impingement of removable partial denture clasps and components, often referred to as “gum-stripping.”
4. Orthodontic bonding coupled with vigorous brushing efforts can precipitate gingival recession.

Also, labial movement of predisposed teeth with thin gingiva, thin bone and frenum pull can lead to gingival recession and root exposure during tooth movement. Alternatively, lingual movement of teeth can improve labial attached gingiva provided an adequate zone of attached gingiva is present and teeth are positioned well within basal bone.

5. Intraoral and perioral piercings can cause mucogingival defects. In fact, the likelihood of labial gingival recession is 7.5 times greater amongst people with a labret (lip piercing) than amongst non-pierced individuals.

TREATMENT OPTIONS

In the past, the gold standard of mucogingival treatment was the free autogenous gingival graft originally described by Sullivan and Atkins.⁶ Over the years many permutations and modifications were made to the technique, such as the laterally positioned pedicle sliding flap and coronally repositioned flap/graft were devel-

CASE EXAMPLES



FIGURE 1



FIGURE 2



FIGURE 3

FIGURE 1—This photo demonstrates the impact of tooth brush abrasion in a 42-year-old female. Right-handed brushers are usually harder on their left sides. Class I Miller defects noted on teeth 22, 42-32, and Class II Miller defects on teeth 23 and 33. 100 percent root coverage can be anticipated with the SCTG and CAF.

FIGURE 2—24-year-old male, with generalized gingival recession. Typical Class III and Class IV Miller defects where there is no chance of achieving 100 percent root coverage. The focus will be rehabilitating a healthy zone of keratinized gingiva to prevent continual gingival recession and consequent tooth loss.

FIGURE 3—Miller Class IV defects with advanced periodontal disease. Poor prognosis and tooth extraction is advised.

oped and documented.⁷ The sub-epithelial connective tissue graft (SCTG) was introduced in 1985,^{8,9} and is now the first choice treatment for mucogingival defects. Many biological mediators, bone substrates, non-resorbable and resorbable barrier membranes have been investigated with varying outcomes. However, none of these approaches outperforms the effectiveness of the SCTG and coronally advanced flap (CAF) with regard to improved clinical parameters.¹⁰

McGuire and Nunn¹¹ reported an average of 4.5mm (range of 4-8mm) root coverage with the SCTG. The outcome was maintained over 10 years averaging 3.89mm coverage.¹² Chambrone

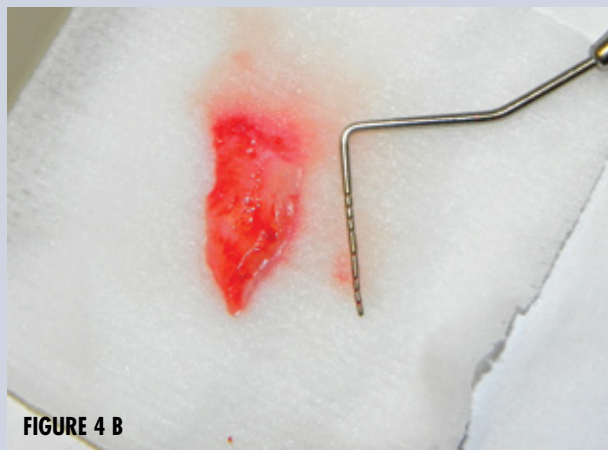
et. al¹³ averaged 84-95 percent mean root coverage with SCTG and CAF. The authors had promising results with enamel matrix derivative and the CAF as well. Unfortunately, acellular dermal matrix allograft (ADM) and guided tissue regenerative (GTR) techniques fell short of long-term expectations. ADM, for example, had excellent one-month results compared with the SCTG at 93.4 percent vs. 96.6 percent root coverage. This dropped to 65.8 percent versus 97 percent success after four years.¹⁴ After 10 years, Nickles et. al¹⁵ demonstrated that GTR dropped from 43.7 percent success to 1.92 percent success as opposed to the SCTG which went from 72.7 percent to 43.7 percent success after 10 years. The SCTG has

the advantage of being harvested from the patient and usually has the best colour match of any other material available. Graft rejection is uncommon and occurs most likely due to less than ideal surgical technique, due to trauma during the healing period or in case of post-surgical infection.

PREDICTABILITY OF ROOT COVERAGE WITH SCTG

We don't wish to disappoint our patients. There are some situations where root coverage would be impossible to achieve. Fortunately, a useful classification system has been prepared by Miller,¹⁶ which includes four categories in order of increasing severity and decreased root coverage expectations.

CASE I



24-year-old male with root sensitivity and cosmetic concern regarding tooth 13. Miller Class II defect with likelihood of achieving significant root coverage.

FIGURE 4 A—Pre-surgical condition demonstrating 5mm root exposure.

FIGURE 4 B—Tissue harvested from palate.

FIGURE 4 C—SCTG placed prior to suturing.

FIGURE 4 D—Primary closure achieved with 5-0 gut sutures with SCTG and marginal CAF with the aim of achieving 100% root coverage.

FIGURE 4 E—One-week favourable post-operative healing.

FIGURE 4 F—One month post-operative photo demonstrating 100 percent root coverage. Full smile, no longer inhibited.

Classification of recession:

Class I: Marginal tissue recession which does not extend to the mucogingival junction. There is no loss of periodontium (bone or soft tissue) in the interdental area, and 100% root coverage can be anticipated (Fig. 1).

Class II: Marginal tissue recession which extends to or beyond

the mucogingival junction. There is no loss of periodontium (bone or soft tissue) in the interdental area, and 100 percent root coverage can be attempted (Figs. 1, 4A & 7A).

Class III: Marginal tissue recession extends to or beyond the mucogingival junction. There is bone or soft tissue loss in the

interdental area, and/or there is malpositioning of the teeth which prevents attempting 100 percent root coverage. Partial root coverage can be anticipated provided the patient satisfies criteria for surgery stated in this paper (Figs. 5A & 6A).

Class IV: Marginal tissue recession which extends to or beyond

CASE II



FIGURE 5 A



FIGURE 5 B



FIGURE 5 C



FIGURE 5 D



FIGURE 5 E



FIGURE 5 F

One of the most technically challenging areas for mucogingival treatment is the lingual surface of the mandibular anterior dentition. Besides limited access and visibility, one must be cognizant of the fragility of the gingival tissues in this area as well as the associated anatomy of blood vessels, glands and muscle attachments.

FIGURE 5 A—By the time these areas are identified as a problem, the amount of gingival recession is associated with bone loss resulting in a Miller Class III (or IV) defect. Treatment of these defects do not result 100 percent root coverage with mucogingival treatment. This pre-op photo shows gingival recession, root exposure and inadequate attached gingiva for a 51-year-old female patient.

FIGURE 5 B—Gingival recession lesions are usually larger than what is presented clinically. Surgical exposure reveals 5mm root exposure on teeth 41 and 31 lingually compared to clinical presentation of 2mm on the 41 and 1mm on 31.

FIGURE 5 C—Primary closure achieved with 5-0 gut continuum sling sutures, with delicate manipulation of fragile tissues. Notice early ecchymosis in recipient site.

FIGURE 5 D—Donor site sutured.

FIGURE 5 E—One month post-up photo demonstrating 100 percent acceptance of SCTG and 90% root coverage compared to surgical exposure of 5mm

FIGURE 5 F—One month post-op photo showing 100 percent healing of donor site

the mucogingival junction. The bone or soft tissue loss in the interdental area and/or malpositioning of teeth is so severe that root coverage cannot be anticipated (Fig. 3).

Indications for SCTG:

1. A history of increasing gingival recession.
2. Root sensitivity that cannot be solved by root desensitization efforts, small bonded restorations,

- or in the case of abfraction/bruxism lesions, a night guard.
3. Esthetic, cosmetic considerations.
4. In preparation for prosthetic or orthodontic treatment.
5. Facilitation of oral hygiene in

CASE III



FIGURE 6 A



FIGURE 6 B



FIGURE 6 C



FIGURE 6 D



FIGURE 6 E



FIGURE 6 F



FIGURE 6 G

A Miller Class III defect on the lingual aspects of teeth 42-32, demonstrating a higher degree of severity than that of Figure 5.

FIGURE 6 A—Pre-surgical photo with gingival recession identified as increasing over past 1-2 years. Tooth mobility scores increasing over the same period.

FIGURE 6 B—Preparation of the graft recipient site reveals root exposure more severe than expected.

FIGURE 6 C—SCTG harvested from posterior palate and transplanted onto recipient site.

FIGURE 6 D—Primary closure of recipient site with attempt at achieving 100 percent root coverage.

FIGURE 6 E—Donor site sutured (primary closure).

FIGURE 6 F—One-month post-operative photo. Notice Class III Miller defect restored but root exposure is residual from the surgical effort because of associated bone loss at time of diagnosis. Periodontal stability, however, has been established with the SCTG.

FIGURE 6 G—Donor site completely regenerated at one-month post-operative visit.

situations where thin gingiva interferes with proper oral hygiene due to gingival sensitivity.

Situations where 100 percent

root coverage with the SCTG is unlikely to occur:

1. Compromised general health
2. Smoking (less root coverage is achieved in smokers versus

non-smokers)

3. Low compliance (non-collaborative patients)
4. Miller Class III and IV recession defects

CASE IV



FIGURE 7A



FIGURE 7B



FIGURE 7C



FIGURE 7D



FIGURE 7E

A 30-year-old female with significant concerns regarding the cosmetics of the labial aspect of her lower front teeth, 41 and 31. Root sensitivity was addressed with desensitizing agents and although the entire lower anterior region demonstrated gingival recession, the patient was focused on the 41 and 31.

FIGURE 7 A—Pre-op photo demonstrating lack of adequate keratinized gingiva and area 35 previously treated with a conventional soft tissue autogenous graft.

FIGURE 7 B—Labial gingiva sutured carefully with the SCTG interposed with this Miller Class I defect

FIGURE 7 C—Palate secured with 5-0 gut suture

FIGURE 7 D—Two-week post-operative healing is favorable

FIGURE 7 E—One-month post-op demonstrating 100 percent root coverage with significantly rebuilt mucogingival environment with excellent colour match

In general, the best results for root coverage are achievable with mucogingival surgery when the gingival recession is characterized by:

1. Thin, short area of root exposure;
2. Isolated and localized presentation;
3. Minimal frenum involvement;
4. Healthy interdental bone and attached gingiva support;
5. Absence of root prominence

(which usually is associated with a thin labial bony plate);
6. Absence of facial dehiscence or fenestrations which may be exposed during surgery

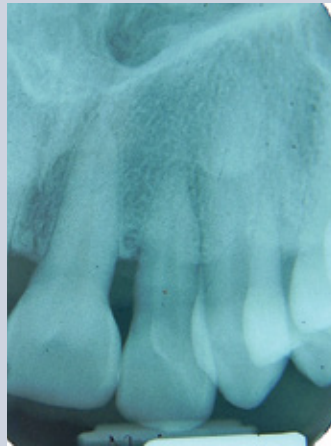
Cairo et. al⁵ developed a useful root coverage esthetic score which can be used to objectively assess the outcome of mucogingival surgery. Six points are given for complete root coverage, 0 for none, and 1 point each awarded for mar-

ginal tissue contour, soft tissue texture, mucogingival junction alignment and gingival colour.

CONCLUSIONS

Mucogingival defects can result from a myriad of conditions. Successful management requires that all predisposing and precipitating factors are identified ahead of the treatment and that the treatment addressed the once that can be altered. Unfortunately, in advanced

CASE V



38-year-old female with significant bone loss at tooth 22 slated for extraction and replacement with an implant-supported restoration.

FIGURE A—Pre-operative photo demonstrating gingival recession also associated with mobile tooth 22

FIGURE B—Radiograph of area before extraction and bone graft.

FIGURE C—SCTG harvested from left palate with gently extracted 22

FIGURE D. SCTG secured on palatal aspect with resorbable gut sutures covering a bone graft placed into socket 22 (synthetic bioactive glass was utilized). Palate also secured with primary closure, gently appositioning all surgical margins

cases (i.e. Miller Class III and IV defects), 100 percent root coverage cannot be achieved.

The gold standard presently for managing mucogingival defects is the subepithelial connective tissue graft, and is currently the first choice treatment for handling mucogingival pathology.

Connective tissue grafting and implants

Connective tissue grafting has applications in the field of dental implantology as well. It is known that tooth extraction can be as-

sociated with a severe depletion of the alveolar process.¹⁸ Schrepp et. al¹⁹ reported that nearly 66% of the alveolar bone undergoes resorption within the first three months of tooth extraction. Efforts were therefore directed towards the concept of immediate placement of implants in fresh extraction sockets. Unfortunately, immediate implant placement does not stop buccal bone and soft tissue remodelling following tooth extraction. Boticelli et. al²⁰ found a 56% reduction of buccal tissue volume versus 27% lingual tissue reduction following immedi-

ate implant placement resulting in related esthetic problems reported in a high percentage (40%) of immediate implants. Chen et. al,^{21,22} also reported that almost 1/3 of their immediate implants showed unsatisfactory esthetic results which were also associated with several factors including (a) the thickness of the facial bone wall, (b) tissue biotype, and (c) implant positioning within the extraction sockets. Factors such as thin biotype constitution are successfully and predictably corrected with connective tissue grafting procedures.

CASE V



FIGURE E—CAF contributed to the ridge augmentation effort

FIGURE F—Three-month healing showing significant enhancement of soft tissue profile of area 22. The implant will be placed 4-6 months after coincidental hard and soft tissue augmentations

FIGURE G—Occlusal view of regenerated 22 socket area

FIGURE H—Essex appliance preferred by patient as a transitional tooth replacement measure. Without hard and soft tissue augmentation at time of extractions, significant collapse of the marginal ridge would have occurred, compromising the cosmetic end result.

With the above concerns in mind, many clinicians favour a delayed implant placement protocol. Contour augmentation using connective tissue grafts with coincidental bone grafts can improve the chances for better esthetic outcomes because they compensate for ridge alterations which always occur after tooth extractions.²³ Facial bundle bone is very vulnerable to surgical trauma compromising blood supply to the surgical site.¹⁸

When simultaneous hard and soft tissue augmentation were pro-

vided with a delayed or immediate implant placement, Fagan et. al²⁴ reported results of great interest. 100% of 25 implants were successfully restored without any cosmetic complications in the delayed implant placement group; 11 of 12 implants succeeded (91.6% integrated) in the immediate implant placement group where cosmetics was described as “adequate” vertical height of hard tissue.

A tremendous variety of bone and membrane grafting materials are available for ridge augmentation and socket preservation

treatment, and include allografts, xenografts, and synthetic materials. However, no protocol for ridge preservation has been proven superior to another.²⁵ The importance of the membrane cannot be overemphasized, because it contains the graft material and presents epithelial down growth into the healing site. This author’s preference is the connective tissue graft because it is easily available, it is an auto-graft which the body will embrace as its own, it works very well when placed correctly, and patients embrace it as a choice compared to

CASE VI



FIGURE 9 A



FIGURE 9 B



FIGURE 9 C

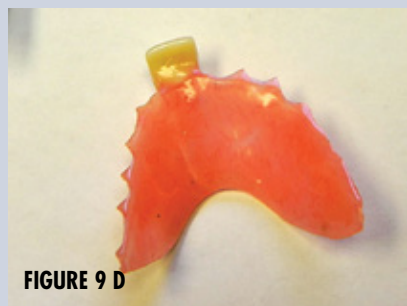


FIGURE 9 D



FIGURE 9 E



FIGURE 9 F



FIGURE 9 G



FIGURE 9 H

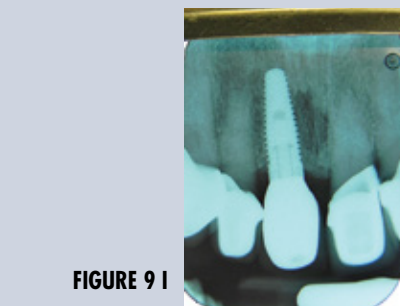


FIGURE 9 I

65-year-old female with a fractured tooth 11 in a highly esthetically-sensitive zone. Adjacent teeth demonstrate increased mobility and the patient did not want a bridge.

FIGURE 9 A—Pre-op photo demonstrated a high lip line with crown fractured to gum line

FIGURE 9 B—SCTG harvested and sutured carefully over the surgical socket filled with a bone graft material after gentle tooth extraction

FIGURE 9 C—Palate also secured with resorbable 5-0 gut sutures

FIGURE 9 D—Acrylic RPD used as transitional tooth replacement measure

FIGURE 9 E—Healing at six months showing success of coincidental hard and soft tissue augmentation

FIGURE 9 F—Implant placed (Nobel Replace Tapered groovy Ti-unite 4.3x13mm) and augmented tissue adjusted accordingly

FIGURE 9 G—Restored tooth 11 with intact gingival margins

FIGURE 9 H—Broad smile, patient satisfied (case restored by Dr. John Glenn Jr.)

FIGURE 9 I—Periapical of end result showing osseous harmony and a suitably sized implant for the area

foreign materials derived from human or animal donors. The disadvantages of delayed implant placement are the need to wear a transitional tooth replacement appliance (Essex appliance (Fig. 8H); conventional and less com-

fortable acrylic RPD (Fig. 9D); or bonded acrylic tooth) and a 3-6 month healing window before the implant can be placed. Greater predictability of hard and soft tissue positioning may be worthy of this consideration before implant

placement in the esthetic zone.

General considerations

Ridge augmentation/preservation is a delicate procedure requiring minimal flap elevation, gentle atraumatic tooth extraction with

degranulation of socket.²⁶ The connective tissue graft is placed over the bone graft and gently sutured within the socket and any transitional tooth replacement choice is adjusted with full clearance from the surgical site preventing direct pressure on the site. Direct application of antimicrobials, such as chlorhexidine gluconate 0.12 percent are useful in plaque control of post-surgical site.

Contraindications:

1. Compromised general health (e.g. uncontrolled diabetes)
2. Severe occlusal or intermaxillary discrepancy

7. Previously untreated periodontitis
8. Acute infection of the tooth site
9. Absence or >50 percent loss of the buccal plate

(The above are exclusion criteria from the major studies cited in this article)^{19,22}

CONCLUSIONS

The SCTG has many applications in the field of periodontology for treatment of gingival recession and includes surgical management of implants in the esthetic zone as well. These grafts are highly desirable because of their autogenous nature and colour match potential.

Greater predictability of hard and soft tissue positioning may be worthy of this consideration before implant placement in the esthetic zone

3. Severe parafunctional habits (bruxism)
4. Smoking in general (smoking decreases predictability of regenerative treatments significantly⁴)
5. Drug or alcohol abuse
6. Poor oral hygiene (low compliance level, non-collaborative patients)

They are, however, technique-sensitive. Discussing this procedures in detail and in advance informs patients about their choices of treatment and avoids dissatisfaction with the end-results. Having the benefits of the Miller classification of gingival defects and the benefits of delayed implant place-

ment following socket bone grafting with SCTG ridge augmentation in the esthetic zone we can improve our chances to achieve desired results. The SCTG is not a panacea, but it is an excellent adjunct to our armamentarium for solving many mucogingival challenges that we face every day in our dental practices. **OH**

Dr. Eugene Kryshchalskyj was an associate clinical instructor at the University of Toronto Faculty of Dentistry Periodontics Division for over 10 years and published many articles on periodontics in referenced journals. He has lectured on periodontics and implant dentistry and presently has a private practice restricted to periodontics and implant dentistry in Toronto, Ontario.

Eugene Gerald Kryshchalskyj is a second year dental student at the University of Western Ontario in London, Ontario.

Alexander Kryshchalskyj is a third year student in biological sciences at McMaster University in Hamilton, Ontario.

Oral Health welcomes this original article.



Reprinted with permission from Oral Health Group Magazine - A Newcom Media Inc Publication