



ROOT COVERAGE PROCEDURES

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Abstract : Gingival recession is defined as “Apical displacement of gingival margin with respect to cemento-enamel junction. Patient-driven concerns about gingival recession are also raised if it interferes with comfort (e.g. root sensitivity) and/or function. Besides aesthetics and patient-centred criteria regarding root coverage procedures, complete root coverage, recession reduction and increased keratinized tissue height are broadly recognized endpoints. Different surgical strategies have been proposed for the correction of gingival recessions, which include free gingival graft, connective tissue grafts, pedicle flaps, guided tissue regeneration with resorbable or non-resorbable membrane and biologic agents. The current gold standard for root coverage is the sub-epithelial Connective Tissue Graft (SCTG) technique, which requires tissue harvested from the palate and placed over an appropriate recession defect with coronal advancement of the flap over the donor graft. Recently, human amniotic membrane (AM) has been reported to have regenerative potential that facilitate repair in the field of oral and periodontal surgeries. Self-adherence ability of the AM makes it an attractive option for correction of recession defects involving multiple teeth in particularly inaccessible areas like the molar region.

IndexTerms – Recession, Root coverage, soft tissue coverage, Connective tissue graft.

I.INTRODUCTION

Gingival recession is defined as “Apical displacement of gingival margin with respect to cemento-enamel junction¹”. Since the apical movement of the gingival margin is also associated with a loss of the other components of the periodontium, J.E. miller suggested that the term “periodontal recession” would provide a more accurate representation of this clinical condition. However, both terms are often used synonymously in the scientific literature to describe this clinical entity.

Dental aesthetics which is compromised by gingival recession, is a common concern for patients. However, this awareness is often limited to those patients with pronounced gingival display and their focus infrequently goes beyond the facial aspect of the anterior dentition⁴. Patient-driven concerns about gingival recession are also raised if it interferes with comfort (e.g. root sensitivity) and/or function.

Besides aesthetics and patient-centered criteria regarding root coverage procedures, complete root coverage, recession reduction and increased keratinized tissue height are broadly recognized endpoints⁶. With this respect, the coronally advanced flap and its modifications combined with autologous connective tissue graft offer the best prognosis to treat single and multiple gingival recessions.

Different surgical strategies have been proposed for the correction of gingival recessions, which include free gingival graft, connective tissue grafts, pedicle flaps, guided tissue regeneration with resorbable or non-resorbable membrane and biologic agents. The current gold standard for root coverage is the sub-epithelial Connective Tissue Graft (SCTG) technique, which requires tissue harvested from the palate and placed over an appropriate recession defect with coronal advancement of the flap over the donor graft.

Numerous agents have been suggested for root bio-modification to eliminate the smear layer and expose collagen fibrils during root coverage procedures⁴. This procedure renders the root surface more suitable for cellular events, such as fibroblast migration and attachment.

Recently, human amniotic membrane (AM) has been reported to have regenerative potential that facilitate repair in the field of oral and periodontal surgeries⁷. Self-adherence ability of the AM makes it an attractive option for correction of recession defects involving multiple teeth in particularly inaccessible areas like the molar region.

RESEARCH METHODOLOGY**Data and Sources of Data**

For this study secondary data has been collected. From the textbooks of Carranza's clinical periodontology, Lindhe and from different journals from websites such as PUBMED, SCOPUS and WEB OF SCIENCE.

Theoretical framework**Gingival Connective Tissue**

The connective tissue of the gingiva is located immediately beneath the epithelial layer and is also known as the lamina propria. Main components of gingival connective tissue include collagen fibers, fibroblasts, vascular elements, nerves, and ground substance⁸. The collagen fibers constitute a major part of the connective tissue volume (60%) and are organized in variously oriented fiber bundles. This dense network of collagen fiber bundles provides the most coronally positioned connective tissue attachment to the tooth surface. The fiber bundles also brace the marginal gingiva against the tooth and thus reinforce the attachment of the junctional epithelium to the tooth.

Gingival tissues required

The gingiva (keratinized tissue) is designed to withstand the frictional forces of mastication and to provide effective protection against bacterial invasion. The question whether a certain amount of keratinized tissue is required for the maintenance of periodontal health and prevention of gingival recession has been controversial for many years⁷. There are different clinical scenarios that are associated with greater plaque accumulation, inflammation, and gingival recession. In these cases, a minimum amount of 2 mm of keratinized tissue with 1 mm of attached gingiva has been recommended for preventing attachment loss and recession.

Classifications**Classification of Sullivan and Atkins**

- Deep-narrow
- Deep-wide
- Shallow-narrow
- Shallow-wide

Mlinek et al (1973)

It is based on results of root coverage with mucosal grafts, quantified

- ✓ Shallow-narrow clefts as being < 3mm in both dimensions.
- ✓ Deep-wide defects as being > 3 mm in both dimensions.

Liu and Solt (1980)

It is based on the visibility of the recession

- ✓ Visual recession – It is measured from the cemento-enamel junction to the soft tissue margin.
- ✓ Hidden recession – It refers to loss of attachment within the pocket i.e apical to the tissue margin.

Classification of P.D. Miller (1985)¹²

Miller described gingival recessions according to the soft and hard tissues.

- ✓ Class I: The gingival recession doesn't extend to the mucogingival junction (MGJ). There is no loss of interproximal hard or soft tissues.
- ✓ Class II: The gingival recession extends to the MGJ. There is no loss of interproximal hard or soft tissues. Moreover, this classification could be divided into two sub-groups:
- ✓ Class IIa: A very narrow band of keratinized gingiva (1 mm or less) stills remaining apically to the gingival defect.
- ✓ Class IIb: No keratinized gingiva band is distinguished apically to the gingival recession.
- ✓ Class III: The gingival recession extends to or further on the MGJ, with some interproximal attachment losses. The gingival margin is located apically to the interdental bone.
- ✓ Class IV: The gingival recession extends to or further on the MGJ, with an advanced interproximal attachment loss. The gingival margin is located coronally to the interdental bone.

Smith's Index of recession**The Horizontal component**

0 – no clinical evidence of root exposure

1- as 0, but a subjective awareness of dentinal hypersensitivity in response to a 1 second air blast is reported and/or

There is clinically detectable exposure of the CEJ for upto 10 % of estimated distance, a slit like defect.

2 – Horizontal exposure of the CEJ > 10% but not exceeding 25 % of the estimated mid mesial-mid distal distance

3 – Exposure of the CEJ > 25 % of the mid mesial-mid distal distance but not exceeding 50%

4 – Exposure of the CEJ > 50 % of the mid mesial-mid distal distance but not exceeding 75%

5 – Exposure of the CEJ > 75 % of the mid mesial-mid distal distance up to 100%

The vertical Component

0 – no clinical evidence of root exposure

1 – as 0, but a subjective awareness of dentinal hypersensitivity is reported and/or there is clinically detectable exposure of the CEJ not extending > 1mm vertically to the gingival margin.

2 – 8 – root exposure 2-8 mm extending vertically from the CEJ to the base of the soft tissue defect.

9 – root exposure > 8 mm from the CEJ to the base of the soft tissue defect.

Norland and Tarnow (1998)

Normal – Interdental papilla fills embrasure space to the apical extent of the interdental contact point/area

Class 1 – Tip of the interdental papilla lies between the interdental contact point and most coronal extent of interdental CEJ.

Class 2 – Tip of interdental papilla lies at or apical to interproximal CEJ but coronal to apical extent of facial CEJ.

Class 3 – The tip of interdental papilla lies level with or apical to facial CEJ.

Mahajan's modification of Millers classification (2010)¹³

Class I – Gingival Recession Defects not extending to the MGJ.

Class II – Gingival Recession Defects extending to the MGJ / beyond it.

Class III - Gingival Recession Defects with bone or soft tissue loss in the interdental area up to cervical 1/3rd of the root surface and/or mal-positioning of the teeth.

Class IV – Gingival Recession Defects with severe bone or soft-tissue loss in the interdental area greater than cervical 1/3rd of the root surface and/or severe mal-positioning of the teeth.

Prognosis

BEST – Class I and Class II with thick gingival profile.

GOOD – Class I and Class II with thin gingival profile.

FAIR – Class III with thick gingival profile.

POOR – Class III and class IV with thin gingival profile.

Francesco Cairo et al (2011) Classification based on the assessment of clinical attachment level at both buccal and interproximal sites.

- Recession Type 1(RT1) Gingival recession with no loss of interproximal attachment. Interproximal CEJ was clinically not detectable at both mesial and distal aspects of the tooth.
- Recession Type 2(RT2) Gingival recession associated with loss of inter-proximal attachment. The amount of interproximal attachment loss was less than or equal to the buccal attachment loss.
- Recession type 3 (RT3) Gingival recession associated with loss of inter-proximal attachment. The amount of interproximal attachment loss was higher than the buccal attachment loss.

Predisposing Factors for Gingival Recession

- Bone Dehiscence/Fenestration Defects
- Dimensions of Gingiva
- Oral Piercings
- Thin Gingival Biotype
- Abnormal Tooth Position
- High Frenum Attachment

Prognostic Factors: Defect Related Factors

- ✓ Recession size
- ✓ Adjacent papilla dimension
- ✓ Keratinized tissue
- ✓ Non carious cervical lesions
- ✓ Tooth malposition and location

Prognostic Factors: Patient Related Factors

- ✓ Plaque control
- ✓ Tooth brushing
- ✓ Tobacco smoking

Root coverage procedures

They are the surgical techniques that treat gingival recession, or receding gums, by covering exposed tooth roots.

Indications

- ✓ Root sensitivity
- ✓ Esthetics

- ✓ Protect root surface from caries/abrasions
- ✓ Augment keratinized tissue
- ✓ Gingival margin inconsistency

Contraindications

- ✓ Systemic conditions
- ✓ Poor oral hygiene
- ✓ Smoking
- ✓ Donor tissue thickness

Free Gingival Graft – Bjorn, 1963

A free gingival graft harvested from the tuberosity was used for the treatment of gingival recessions¹¹

Different surgical procedures were used:

Free gingival graft, coronally advanced flap, connective tissue graft, double papilla flap, and combined approaches. Currently, the FGG is the most widely used surgical procedure for the augmentation of keratinized tissue.

Indications

- ✓ Increasing the amount of keratinized tissue (more specifically attached gingiva)
- ✓ Increasing the vestibular depth
- ✓ Increasing the volume of gingival tissues in

Contraindications

- ✓ A precipitable mismatch in color between donor site and gingiva adjacent to recipient site.
- ✓ A lack of thick donor tissue.
- ✓ A class III or class IV recession defect.
- ✓ A root surface of excessive mesio-distal width coupled with interproximal tissue that is too narrow to support the blood supply.

Sub-epithelial Connective Tissue Graft – Langer and calagna, 1980

It has become the first grafting approach of choice during the last three decades. Sub epithelial connective tissue graft transplantation is one of the most versatile and esthetically predictable grafting procedures in periodontal plastic surgery¹³. The application of it in combination of split-thickness pedicle-, envelope-, or tunnel-type flaps aims at the bilaminar reconstruction of lost gingival tissues using both free and recipient connective tissue layers to preserve graft viability and to cover denuded root surfaces. As a result of the dual graft blood supply (from the underlying periosteum and the overlying mucosal flap), results in improved root coverage.

Trap Door Technique – Edel, 1974

This technique utilizes mesial and distal vertical incisions according to the graft dimensions. A longitudinal incision from mesial to distal along the palate is used to connect the releasing incisions to elevate a partial-thickness trap door. Vertical incisions should be extended 1 mm further over intended apico-coronal dimension of the graft, thus allowing for better access to the apical incision line, used for the removal of a connective tissue graft from underneath the trap door by means of split-thickness sharp dissection as described for the single-incision technique. After removing the connective graft, single interrupted or horizontal/modified crossed mattress sutures can be used to achieve wound closure. Donor site-related complications including secondary intention wound healing and postoperative bleeding might occur, mainly as a result of vertical incisions.

Parallel Incision Technique – Langer and Langer, 1985

At 2- and 4-mm distance from the gingival margin, two longitudinal parallel split-thickness incisions are made (as described for the single-incision technique below) in 8–10 mm depth into the palate with vertical releases at the mesial and distal extent of the incision, similar to the trap door technique¹². An incision at the base of the connective tissue between the vertical incisions deliberates the graft from the palatal bone. A subepithelial connective tissue graft is obtained by removing the epithelial collar determined by the first parallel incisions. Donor site-related complications are comparable to the trapdoor approach, with more pronounced secondary intention wound healing.

Single-Incision Technique – Bruno, 1965

First, a single full-thickness incision is performed with a Nr. 15 surgical blade 90 degrees to the palatal bone, after which the blade is angled from 135 to 180 degrees to undermine the palatal masticatory mucosa in split thickness toward the palatal midline. This incision should not be extended deeper than 8 mm from the single incision. Therefore, a No. 15 scalpel blade might be used as a reference, which has a cutting edge of the approximate length of 8 mm. Subsequently, after opening a palatal envelope, a subepithelial connective tissue graft is obtained by incisions on mesial, distal, and apical sides of the connective tissue within the opened envelope. The most significant advantage of this technique is the less compromised blood supply and simplified closure of the wound due to the lack of vertical incisions; however, visibility is impaired.

Pouch and Tunnel Technique – Pat allen, 1994

It is a technique for root coverage of multiple adjacent recessions, a multi-envelope recipient bed “tunnel”.

Advantages

- ✓ For multiple adjacent teeth
- ✓ Minimize incisions and reflection of flap
- ✓ Abundant blood supply

Coronally Advanced Flap (CAF) – Norberg, 1926

As it requires only one surgical site, this technically simple procedure is well accepted by patients (low morbidity). In addition, good clinical outcomes especially the esthetic appearance could be achieved by this surgical technique⁸. A trapezoidal flap design and a split-full-split thickness flap elevation were made to this surgical technique. Different authors reported that this modified CAF procedure leads to achieve successful long-term clinical results regarding root coverage of localized Miller Class I and II gingival recessions.

Envelope Technique – Szmyd, 1971

The envelope technique is used to cover Miller class I, II, and III gingival recessions. A split-thickness envelope flap (gingival pouch) is prepared by sharp dissection via 15C or microsurgical blades, starting from the sulcus toward the adjacent papillae, in a depth determined by the previously harvested graft size. Subsequently, an SCTG or an ESCTG is placed into the envelope at the level of the cemento-enamel junction. Graft and flap fixation is carried out by 5/0 or 6/0 non-resorbable monofilament single interrupted, mattress or sling sutures. Sutures are removed after 14 days. The uncovered part of the graft shows desquamation and reepithelization similar to free gingival graft during the healing period; however, this does not result in visible color blending heterogeneity compared to recipient tissues. A major advantage of this technique is the lack of coronal flap advancement, which makes the ET feasible to treat sites with a shallow vestibular fold, especially the anterior mandible.

Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique – Homazaden, 2011

- A minimally invasive surgical procedure to treat maxillary anterior contiguous recessions Access to the surgical site is obtained by means of an approach referred to as vestibular incision sub periosteal tunnel access¹¹.
- VISTA allows for both access as well as an opportunity to coronally reposition the gingival margins of all involved teeth.
- A single vertical incision given at the midline is used to coronally displace the full thickness muco periosteal flap on either sides.

Laterally Positioned Flap – Grupe and Warren, 1956

Although the bilaminar technique is currently the gold standard in root coverage, the laterally positioned flap remains an effective, a simple, and a predictable procedure in cases of isolated gingival recession defects leading to good esthetic result with lower morbidity. It is widely used in cases of localized gingival recessions¹². It is indicated particularly when the local anatomic conditions could make the CAF unfeasible. These anatomical conditions include the absence or the lack of keratinized gingiva apically located to the gingival recession, the presence of a very shallow vestibulum and/or an aberrant frenal attachment. In such situations, the clinician could take into consideration the amount of keratinized tissue adjacent to gingival recession in order to assess the possibility to use a laterally positioned flap.

Root coverage using soft tissue substitutes

- ✓ Graft-assisted procedures – Enamel matrix derivative
- ✓ Non-graft assisted procedures – Guided tissue regeneration, Root surface biomodification
- ✓ Advanced techniques – Growth factors, stem cells and tissue engineering

Healing following free soft tissue grafting procedures**3 days (Initial Phase):**

- ✓ Plasmatic circulation
- ✓ Epithelium degenerates and desquamated

2-11 days (Revascularization Phase):

- ✓ Anastomoses and fibrous union are established
- ✓ If a free graft is placed-apical migration of epithelium along the tooth-facing surface of the graft may take place.

11-42 days (Tissue maturation Phase):

- ✓ Approximately 14 days vascular system of the graft appears normal and epithelium gradually matures with the formation of a keratin layer.

Healing following pedicle soft tissue grafts

- 1.The adaptation stage (0-4 days): The pedicle graft is separated from root by a thin fibrin layer. Epithelium covering the transplanted tissue flap reaches the tooth surface after a few days
- 2.The proliferation stage (2-21 days): Fibrin layer between root surface and flap is invaded by CT from subsurface of flap. After 6-10 days a layer of fibroblasts is seen in opposition to the root surface
At the end of proliferation stage, thin collagen fibers are formed adjacent to root surface without fibrous union. From the coronal edge of the wound, epithelium proliferates apically along the root surface
- 3.The attachment stage (27-28 days): Thin collagen fibers become inserted in a layer of new cementum
- 4.The maturation stage: Continuous formation of collagen fibers.

Complications Associated with Recession Coverage Procedures

- ✓ Patient-related factors, smoking has shown to be associated with poorer outcomes following root coverage procedure. An apical relapse of the gingival margin sites has also been attributed to a resumption of traumatic tooth brushing habits at treated sites.
- ✓ Site-related factors that may influence treatment outcome include the interproximal bone height and attachment level (Miller classification), defect size, presence of frenal attachment, tooth malposition, presence of cervical lesions, vestibulum depth, and tissue thickness¹².
- ✓ Technique-related factors such as flap stability, positioning of the gingival margin, use of vertical releasing incisions, and application of microsurgical techniques should also be considered since they may influence the degree of root coverage.
- ✓ Patients undergoing a FGG procedure were three times more likely to develop post-surgical pain or bleeding compared to other root coverage techniques and show postoperative shrinkage of the graft.
- ✓ potential complications include excessive haemorrhage, postoperative bone exposure at the palatal donor site, recurrent herpetic lesions of the palate, lack of graft stabilization to the underlying tissue, and failure of graft survival.
- ✓ However, the severity of post-operative complications was rated as mild or moderate in most of the cases. Most of the complications after CTG procedures are associated with the palatal donor site and are closely related to the graft harvesting technique. In this context, knowledge of the anatomy in the donor area and selection of sites with adequate tissue thickness are critical in preventing complications.

Post surgical care

Postsurgical care begins immediately after surgery. It lasts for the duration of the healing process and may continue after until the complete tissue remodeling. As part of the postoperative care, it is important to explain to the patients all about the potential side effects and complications of the medication and the surgical procedure and how to manage each of them. After the surgical procedure is completed, the patient should receive the postsurgical instructions and preferably a written form with the recommendations and prescription of analgesics, anti-inflammatory agents, and antibiotics when needed.

Drugs	Prescription
Ibuprofen 600 mg	Every 4-6 h for 3-5 days
Dexamethasone 4-8 mg	1h before surgery
Amoxicillin 500 mg	2 tabs stat and then 1 tab t.i.d for 7 days
Azithromycin 250 mg*	2 tabs stat and then 1 tab q.d for 4 days
Clindamycin 150 mg*	2 tabs stat and then 1 tab q.i.d for 7 days
Doxycycline 100 mg*	2 tabs stat and then 1 tab b.i.d for 7 days
Chlorhexidine gluconate 0.12 %	b.i.d for 30 s for 14 days

*Allergic to penicillin

Conclusion

Root coverage procedure can provide significant reduction in gingival recession depth for most defects and patients. Sub-epithelial connective tissue graft provides the best outcomes for mean root coverage and complete root coverage, as well as increase in keratinized tissue. Additionally, biomaterials such as Acellular dermal matrix graft and Enamel matrix derivative in conjunction with Coronally advanced flap used as alternative to autogenous donor tissue when necessary or desired.

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