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Comparative evaluation of coronally positioned flap with or without using a collagen barrier membrane for root coverage procedures: A clinical study

Anup Cholepati[1]* • S.S. Doiphode[2] • Motilal Jangid[3]

[1]Reader, Department of Periodontics, CSMSS Dental College and Hospital, Kanchanwadi, Aurangabad, India
[2]Guide and Professor, Department of Periodontics, CSMSS Dental College and Hospital, Kanchanwadi, Aurangabad, India
[3]Reader, Department of Periodontics. SD Dental College and Hospital, Parbhani, India
*Corresponding Author; E-mail: dr.anupcholepatil@gmail.com

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Abstract

Gingival recession is defined as displacement of gingival margin apical to cementoenamel junction. Over the years gingival recession has been treated by a number of surgical techniques. Conventional mucogingival procedures such as the laterally positioned flap, free gingival graft, connective tissue graft and coronally positioned flap have been shown to be relatively successful in achieving root coverage. Gingival tissue regeneration (GTR) based root coverage has emerged as an alternative treatment because it demonstrates histologically new attachment formation. The aim of this study was to compare coronally positioned flap procedures in gingival recession defects with or without using a collagen barrier membrane.

Key words:

Introduction

Gingival recession is defined as displacement of gingival margin apical to cementoenamel junction.[1] Common causes of recession include a traumatic tooth brushing technique, periodontal diseases, high muscle attachment and frenal pull, tooth position, alveolar bone dehiscence and iatrogenic factors. Consequences of gingival recession include problems associated with esthetics, root sensitivity and/or root caries.[2]

Over the years gingival recession has been treated by a number of surgical techniques. The selection of one surgical technique instead of another depends upon the local anatomic characteristics of the site to be treated and on the patient's esthetic demands. Conventional mucogingival procedures such as the laterally positioned flap, free gingival graft, connective tissue graft and coronally positioned flap have been shown to be relatively successful in achieving root coverage. Coronally advanced flap (CAF) is the first choice surgical technique when there is adequate keratinized tissue apical to the recession defect.[3]

Gingival tissue regeneration (GTR) based root coverage has emerged as an alternative treatment because it may not only achieve similar clinical results to those of traditional root coverage procedures, but also it exhibits histologically new attachment formation.[4] Root coverage using GTR offers advantages such as no need for donor tissue, commercially

available materials and esthetic outcomes as comparable to traditional approaches.[5] First described by Nyman et al in 1982, GTR procedures initially employed non-biodegradable barriers that were surgically removed from the wound site after a period of healing.

The aim of this study was to compare coronally positioned flap procedures in gingival recession defects with or without using a collagen barrier membrane (Periocol).

Materials

Fifteen patients (12 males and 3 females), aged 23–50 years, with no contraindications for periodontal surgery and two Millers class I or class II buccal gingival recession defects >2 mm (recession depth difference between the right and left defects <2 mm) in a split-mouth design, were selected from the Outpatient Department of Periodontics, for this study.

The initial preparatory stage consisted of implementation of oral hygiene regime to eliminate the incorrect practices along with scaling, root planing and polishing. The teeth selected for the study included 24 maxillary canines and 6 first premolars.

All the clinical measurements were recorded with the use of a Williams probe at baseline, 3 months and 6 months. The following parameters were recorded of the selected teeth using custom-made acrylic stent to obtain standardized measurements by one examiner.

1. Recession depth: measured from the CEJ to the gingival margin (GM).
2. Probing depth: measured from the GM to the bottom of the gingival sulcus.
3. Clinical attachment level: measured from the CEJ to the bottom of the sulcus.
4. Width of keratinized tissue: measured from the mucogingival junction (MGJ) to the GM. Mucogingival junction was demarcated by Lugol's solution.

At the end of the 3 months and 6 months, percentage of root coverage (PRC) was calculated by using the formula:

$$\text{Root coverage} = \frac{\text{Recession depth (Preoperative} - \text{Postoperative)}}{\text{Recession depth (Preoperative)}} \times 100$$

The test site surgical procedure

Following local anesthesia with 2% lignocaine containing adrenaline at a concentration of 1:200,000, an intrasulcular incision and two diverging vertical incisions (i.e. one mesial and one distal) extending beyond the mucogingival junction were placed on the involved tooth with a #15 blade (Figure 1). Care was taken to place the vertical incisions at the line angles of the tooth and not on the mid-root surface or at the middle of the interdental papilla, which was followed by raising of a full-thickness flap. A partial thickness, trapezoidal flap was elevated beyond the mucogingival junction. The adjoining interdental papillae were stripped off the epithelium with a blade to provide a raw vascular bed for the coronally positioned flap. The exposed root surfaces were thoroughly planed using curettes.

Figure 1. Incision.

A measurement of the approximate length and width of the collagen membrane required was obtained by means of a foil template. The collagen membrane (Periocol) was aseptically removed from the pocket with a pair of sterile tweezers. The collagen membrane was subsequently custom-cut, positioned over the root apical to the CEJ with 2–3 mm beyond the bony margin, and secured with 5-0 absorbable sling sutures (Figure 2). Any excessive tissue was trimmed from the flap. The flap was then coronally positioned to cover the membrane and secured with 5-0 absorbable gut sutures at the mesial and distal line angles, respectively (Figure 3). Care was taken

Figure 2. Placement of GTR membrane.

Figure 3. Sutures placed.

to ensure that the flap was free of tension.
For the control site, the same procedure was followed except the use of a barrier membrane.

Results

The mean probing depths in control group at baseline, 3 months and 6 months were 1.46±0.64, 1±0 and 1.06±0.25 mm, respectively. The mean probing depths in the experimental group at baseline, 3 months and 6 months were 1.53±0.51, 1±0 and 0.86±0.35 mm, respectively. By applying Student's t-test there were no significant differences in mean values of probing depth at base line and 3 months between the control and experimental sites (P>0.05), with a significant difference between the mean values of probing depth only at 6 months between the control and experimental sites (P<0.05).
The mean recession depths in the control group at baseline, 3 months and 6 months were 2.53±0.63, 1.13±0.51 and 1.20±0.56 mm, respectively. The mean recession depths in the experimental site at baseline, 3 months and 6 months were 2.33±0.61, 0.86±0.35 and 0.86±0.35 mm, respectively. By applying Student's t-test there were no significant differences in the mean values of recession depth at baseline between the control and experimental sites (P>0.05), with a significant difference in the mean values of probing depths at 3 months and 6 months between the control and experimental sites (P<0.05) (Table 1).
The mean clinical attachment levels (CAL) in the control group at baseline, 3 months and 6 months were 4±0.92, 2.13±0.51 and 2.26±0.70 mm, respectively. The mean clinical attachment levels (CAL) in the experimental group at baseline, 3 months and 6 months were 3.93±0.70, 1.86±0.35 and 1.73±0.45 mm, respectively (Table 1). By applying Student's t-test there were no significant differences in the mean values of CAL at baseline between the control and experimental sites (P>0.05), with a significant difference in the mean values of CAL at 3 months and 6 months between the control and experimental sites (P<0.05).
The mean widths of keratinized tissue (WKT) in the control group at baseline, 3 months and 6 months were 2.53±0.63, 2.73±0.79 and 2.86±1.13 mm, respectively. The mean widths of keratinized tissue (WKT) in the experimental group at baseline, 3 months and 6 months were 2.73±0.70, 3.06±0.70 and 3.40±1.02 mm, respectively (Table 1). By applying Student's t-test there were no significant differences in the mean values of WKT between the control and experimental sites at baseline, after 3 months and after 6 months (P>0.05).
Percentages of root coverage in the control group at 3 months and 6 months were 55.23% and 51.37%, respectively. Percentages of root coverage in the experimental group at 3 months and 6 months were 61.89% and 63.16%, respectively (Table 2).

Discussion

Gingival recession is a common feature in populations with high standards of oral hygiene,[6] as well as in populations with poor oral hygiene.[7] Obtaining predictable and esthetic root coverage is an important part of periodontal therapy.
A variety of surgical techniques that have been proposed to increase the width of keratinized tissue and/or covering of denuded root surface include lateral sliding flap (Grupe & Warren 1956),[8] coronally positioned flaps (Harvey 1965),[9] free gingival grafts (Miller 1982),[10] connective tissue grafts (Langer & Langer 1985[11] and Nelson 1987[12]), a cellular dermal

Table 1. Distribution of mean values of probing depth, recession depth, CAL and WKT in non-membrane treated teeth (control site) (n=15) at baseline, at 3 months and 6 months

Duration	Probing Depth	Recession Depth	CAL	WKT
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Baseline (n=15)	1.46 ± 0.64	2.53 ± 0.64	4.0 ± 0.92	2.53 ± 0.6
3 months (n=15)	1 ± 0	1.13 ± 0.57	2.13 ± 0.51	2.73 ± 0.79
6 months (n=15)	1.06 ± 0.25	1.20 ± 0.56	2.26 ± 0.70	2.86 ± 1.13

Table 2. Distribution of percentages of root coverage in the control and test groups

	Control site (n=15)	Experimental site (n=15)
3 months	55.23%	61.89%
6 months	51.37%	63.16%

matrix allograft (Harris 1998),[13] guided tissue regeneration with nonresorbable (Tinti & Vincenzi 1990)[14] and bioabsorbable barriers (Pini Prato et al 1995)[15] and combination of guided tissue regeneration and bone grafts (Kimble 2004).[16] Pedicle flaps, free soft tissue autografts and combination procedures, like subepithelial connective tissue graft (SCTG), have been used with success to gain root coverage.

Among these, the subepithelial connective tissue graft (SCTG) technique was introduced to increase the predictability of total root coverage. However, disadvantages associated with it include the need for a second surgical site, morbidity linked with harvesting donor grafts, post-surgical bleeding, patient discomfort, limited quantity of donor tissue and frequent need for multiple procedures to achieve optimal results (Kimble 2004).[17]

To overcome the above limitations, recently investigators successfully applied the principle of guided tissue regeneration to promote root coverage. Guided tissue regeneration-based techniques not only yield clinical results similar to those achieved by traditional root coverage but can potentially result in new attachment formation (new bone, new cementum, new periodontal ligament and new connective tissue) (Cortellini et al 1993).[18]

The degradation time of collagen membrane is reported to be 2 to 6 weeks.[19] Iglhaut et al[20] reported that coronal migration of PDL cells peaked within 1 to 2 weeks postoperatively and their mitotic activity decreased 3 weeks after surgery. In view of the above findings and the additional report by Karring et al[21] that apical migration of the epithelium tended to occur within 2 weeks after surgery, it might be necessary to maintain the membrane structure in vivo for at least 3 to 4 weeks.

In this clinical, randomized study, the mean root coverage obtained with coronally advanced flap at 3 months and 6 months was 55.23% and 51.37%; in the collagen membrane group at 3 months and 6 months it was 61.89% and 63.16%. This difference in root coverage between the two groups was statistically significant. The mean root coverage in both groups implies that these surgical procedures have definite therapeutic utility in clinical practice. These results are consistent with the findings of Amarante et al[22] and Wang et al.[23]

The outcome of any root coverage procedure is influenced by many factors, such as demographics of the patients, oral hygiene maintenance, pre-treatment defect size, morphology and thickness of the soft tissue at the defect, measurement techniques employed, and the clinician's surgical experience. These and other factors make comparisons between different studies difficult.

The percentage of root coverage achieved in our study using collagen membrane is similar to other studies mentioned in the literature using bioabsorbable collagen membranes: Shieh et al[24] (52 %) and Kimble[25] (69%).

Pini Prato et al (1996)[26] showed a significant increase in the keratinized tissue width (1.28 mm) during a 4-years follow-up period for GTR-based recession coverage. The possible explanation for the increase in keratinized tissue width is an apical migration of the mucogingival junction towards its original location. This fact seems to confirm the hypothesis that the location of mucogingival junction is genetically determined (Ainamo et al, 1992).[27]

Conclusion

The results of the present study indicated that both treatment procedures were effective in treating recession defects. A better clinical outcome was obtained in the test group with respect to recession coverage and gain in clinical attachment level at the end of the 6-month study period. The success of GTR-based root coverage procedure is probably bringing us closer to our ultimate aim of complete regeneration of lost periodontal tissues.

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