African Journal of Biotechnology Vol. 10(31), pp. 5893-5899, 29 June, 2011
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB10.2583
ISSN 1684-5315 ©2011 Academic Journals

Full Length Research Paper

Clinical comparison of localized gingival recession coverage in root surfaces restored with giomer and intact root surfaces

Reza Pourabbas[1], Soodabeh Kimyai[2]*, Mohammad Taghi Chitsazi[3] and Fatemeh Nourbaksh[3]

[1]Dental and Periodontal Research Center, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran.
[2]Department of Operative Dentistry, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran.
[3]Department of Periodontics, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran.

Accepted 29 April, 2011

This controlled clinical study was aimed to evaluate the root coverage procedures using connective tissue graft (CTG) on non-carious root surfaces in comparison with carious lesions, restored by giomer (g-CTG). Fifteen (15) patients with 30 Miller class I or II defects including 15 carious root lesion (test group) and 15 sound root surfaces (control group) were selected. The carious roots were restored with giomer prior to surgery and then, all the test and control groups were treated with CTG. Probing depth (PD), recession height (RH), recession width (RW), relative clinical attachment level (rCAL), keratinized tissue height (KTH), mucogingival line (MGL), clinical attachment level gain (CALG), recession width reduction (RWR) and percentage of root coverage (RC) were recorded at baseline 1, 3 and 6 months post-operatively. The Friedman test was used to evaluate differences within groups and the Mann-Whitney U test was used to evaluate differences between the groups. Both groups demonstrated significant CALG and RC. The recession width reduction (RWR) was greater for the control group ($P < 0.05$). However, all other Intra- and inter-group analyses showed no significant differences among the groups. The estimated RC was 81.08±19.82% for test and 73.31±23.85% for control group. This study indicated that the use of CTG for treatment of root surfaces restored with giomer was effective over the 6-month period without any noxious effect on periodontal tissues.

Key words: Gingival recession, connective tissue graft, coronally advanced flap, giomer.

INTRODUCTION

Gingival recession is a common occurrence and its prevalence increases with age (Serino et al., 1994). The recession of the gingival, either localized or generalized, may be associated with one or more surfaces, resulting in attachment loss and root exposure (Kassab and Cohen, 2003). Apart from root surface hypersensitivity (Sauro et al., 2007), gingival recession can lead to clinical problems such as root caries, cervical root abrasions, difficult plaque control and diminished cosmetic and aesthetic concerns. Therefore, it should not be viewed as merely a soft tissue defect, but rather as the destruction of both soft and hard tissues (Kassab and Cohen, 2003).

Periodontal marginal tissue recessions have numerous causes, including periodontal diseases, mechanical forces such as faulty tooth brushing, iatrogenic factors like uncontrolled orthodontic movement, improper restorations, viral infections of the gingival and anatomical factors such as tooth malposition and high frenum attachment (Agudio et al., 1987; Trossello and Gianelly, 1979; Donaldson, 1973; Contreras and Slots, 1998; Buckley, 1981).

Root coverage procedures have become an important part of periodontal plastic surgery. Since 1985, the treatment of gingival recession has been influenced by the development of the subepithelial connective tissue

*Corresponding author. E-mail: soodabehkimyai@yahoo.com Tel: 0098411- 3340310. Fax: 0098411-3346977.

graft (SCTG) technique, which has led to predictable and reproducible results. The combined use of a connective tissue graft with a pedicle graft is currently believed to give the maximum percentage of root coverage, ranging from 52 to 97.4%. However, on some occasions, the situation becomes more complex, with the presence of gingival recession with root caries, root resorption or both. In such cases, combined restorative and periodontal surgical procedures should be undertaken. Resin ionomer materials have many properties that allow them to be used successfully in the subgingival region (Alkan et al., 2006). Dragoo demonstrated histological evidence that both epithelium and connective tissue can adhere to the resin ionomer when placed in a subgingival environment (Dragoo, 1997).

A new class of fluoride-releasing resin materials with pre-reacted glass (PRG), called giomer, has been introduced for cervical restorations with claims of good color matching, biocompatibility and fluoride release and fluoride recharge potential (Matis et al., 2004; Yap and Mok, 2002; Pourabbas et al., 2009). They use PRG technology to produce a stable phase of glass-ionomer in the restorative material. The fluoroalumina silicate glass reacts with polyalkenoic acid in water before being incorporated into the silica-filled urethane resin (Yap and Mok, 2002). Therefore, giomer can be considered a potential candidate for restoring cervical defects of teeth before root coverage procedures. Thus, the aim of this study was to clinically evaluate the treatment of gingival recession associated with root restoration by giomer using a connective tissue graft.

MATERIALS AND METHODS

Patient and site selection

Following approval of study by the research and ethics committee of the University, the protocol was officially registered (IRCT138812141248N2). Considering root coverage percentage as the primary outcome, we calculate our sample size by assumption of α= 0.05, d= 0.45 and P= 0.05. The sample size for continuous data was calculated to be 15 defects for each group. This may provide 80% power to detect true difference between test and control groups. Fifteen consecutive cases were selected from the subjects referred to our postgraduate clinic according the following inclusion criteria: having Miller class I or II gingival recession defect (2.5 mm or more) associated with buccal cervical carious lesion in the anterior and premolars regions in the upper and lower jaws for test group and without any buccal cervical defect (caries, abfraction, erosion or abrasion) for control; non-smoking; non-pregnant or non-lactating; periodontally and systemically healthy subjects; presence of 2 mm or more keratinized tissue; absence of pulpal pathology and severe occlusal interferences on the teeth to be treated; probing depth (PD) of 2 mm or less, no bleeding on probing (BOP); no previous surgical intervention at the defect site; existence of dental hypersensitivity or impaired esthetics associated with recession; absence of high frenum attachment; no intraoral fixed or removable appliances; no radiographic evidence of periapical pathology.

The patients were informed of the nature of the study and provided a signed (witnessed) consent to participate in this study.

Initial therapy included dental scaling, polishing and occlusal adjustment as indicated. All the patients were instructed to use a non-traumatic brushing technique (coronally directed roll technique) with a soft tooth-brush.

Experimental design

This study used randomized control clinical design. Each subject was assigned to one of the following groups: group 1 (control group; n= 15): root exposure without any cervical defect treated with CTG and CAF (CTG); group 2 (test group; n= 15): root exposure associated with cervical carious lesion treated with giomer plus CTG and CAF (g-CTG). Data collection and analysis were performed by two persons who were ‘blinded ‘to allocation of the defects to test and control groups. The progress through the various steps of the study is depicted in Figure 1.

Restorative procedures in the test group

In this study, the extension of cervical carious lesions in the selected teeth was limited to the buccal surface of teeth without extension into the proximal surfaces and the teeth had no previous restoration or carious lesion in other surfaces. In addition, the operating area could be isolated. Subsequent to the local anesthesia, isolation was carried out using cotton rolls and retraction cord. Conventional cavity preparation design (with a 90° cavosurface angles; uniform depth of the axial lineangles and retentive grooves) was used for tooth preparation. For this purpose, a diamond bur (010 Flat End Taper, SS White Burs, Inc. Lakewood, NJ, USA) rotating at a high speed with air-water spray was used. Subsequent to caries removal using round carbide bur (SS White Burs, Inc. Lakewood, NJ, USA) at slow speed with air coolant, retentive grooves were placed in gingivoaxial lineangles. No liners or bases were applied. Deep cavities which needed liners or bases for pulp protection excluded from the study. Then, the self-etch adhesive system (FL-Bond, Shofu Dental Corporation, Osaka, Japan) was used according to the manufacturer's instructions. The cavities were restored incrementally using a giomer (Beautifil II, A3 shade, Shofu Dental Corporation, Osaka, Japan). Giomer was cured for 40 s per increment using a conventional quartz halogen light-curing device (Astralis 7, Ivoclar Vivadent, FL-9494 Schaan, Liechtenstein) at a light intensity of 400 mW/cm^2 immediately after placement. Subsequently, the restorations were finished with diamond burs (Diamant Gmbh, D & Z, Goerzallee, Berlin, Germany) and polished with polishing disks (Sof-Lex^{TM}, 3M ESPE, Dental Products, St. Paul, MN, USA). All the restorative procedures were performed by the same operator.

Surgical procedures

Two weeks after the restorative appointment, the patients underwent root coverage surgeries performed by a single operator. At the beginning of the surgical appointment, the root surfaces of the control group were planed thoroughly with manual periodontal curettes, high-speed fine carbide burs and low-speed fine diamond burs until a smooth surface was achieved. After local anesthesia (2% lidocaine with 1:80000 epinephrine), a sulcular incision followed by two horizontal incisions were made at right angles to the neighboring papillae. To accomplish a trapezoidal flap design, two releasing oblique incisions at the mesial and distal parts of the defect extended beyond the mucogingival junction (MGJ). A periosteal elevator was inserted to dissect a primary full-thickness flap. Then, a split-thickness flap was reflected at all the apical, mesial and distal directions, as necessary, to release any tissue tension. The papillae adjacent to the involved tooth were

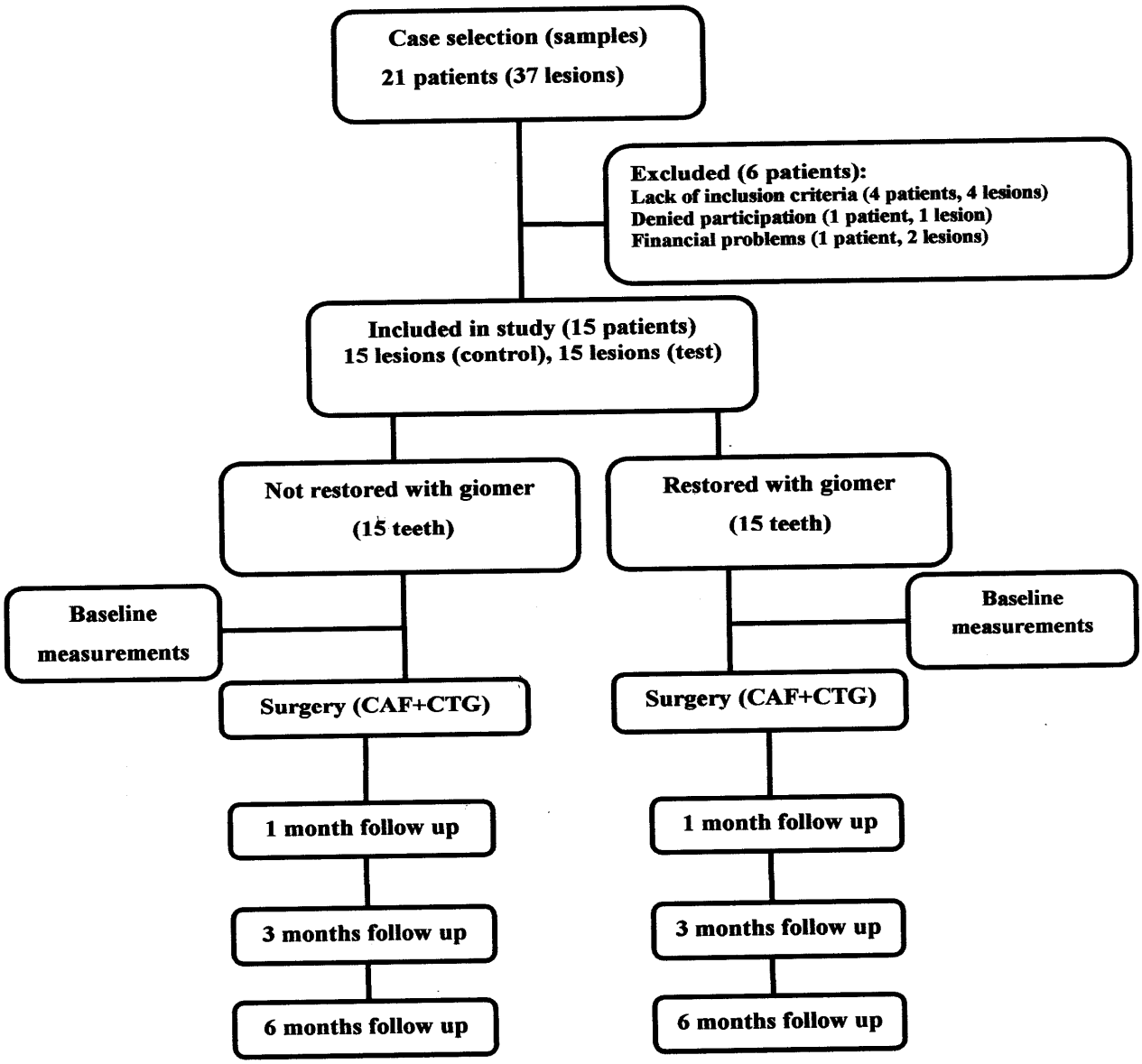

Figure 1. Flow diagram for the study subjects.

deepithelialized. A connective tissue graft was obtained from the palate and placed under the partial-thickness flap. The flap was displaced coronally, completely covering the recession (with or without restoration). Sutures were used to hold the flap in position; then periodontal dressing was placed over the donor and recipient sites (Zucchelli et al., 2003). Chlorhexidine gluconate (0.2%) mouthwash, twice a day for 4 weeks, amoxicillin (500 mg) every 8 h for one week and oral analgesics were prescribed for 3 days, postoperatively. The sutures were removed after 14 days. Weekly follow-ups were scheduled during the first month, then at 3 and 6 month intervals after surgery. Clinical procedures on the control and test groups are represented in Figures 2 and 3, respectively.

Clinical parameters

The clinical parameters were assessed by a calibrated examiner, who was blinded to the test and control groups. The following parameters were assessed on the buccal aspect of all the study teeth at baseline (initial therapy session) and 1, 3 and 6 months after surgeries: (1) PD: distance between the gingival margin (GM) and the bottom of the gingival sulcus; (2) recession height (RH): distance between a fixed landmark [CEJ (cemento-enamel junction] and the most apical point of the GM; (3) recession width (RW) at the CEJ level; (4) relative clinical attachment level (rCAL): distance between a fixed landmark (stent) and the bottom of the gingival sulcus; (5) KTH: distance between the most apical extension of the GM and the MGJ; (6) mucogingival line MGL: distance between MGJ and an acrylic stent.

The assessed clinical parameters were used to obtain recession width reduction (RWR): calculated as preoperative RW- postoperative RW; clinical attachment level gain (CALG): calculated as preoperative rCAL- postoperative rCAL); root coverage percentage (RC): calculated as initial RH/ (initial RH- final RH) ×100 for the two groups. Periodontal measurements were performed with a UNC manual probe (Hu-Friedy, Chicago, IL, USA). An

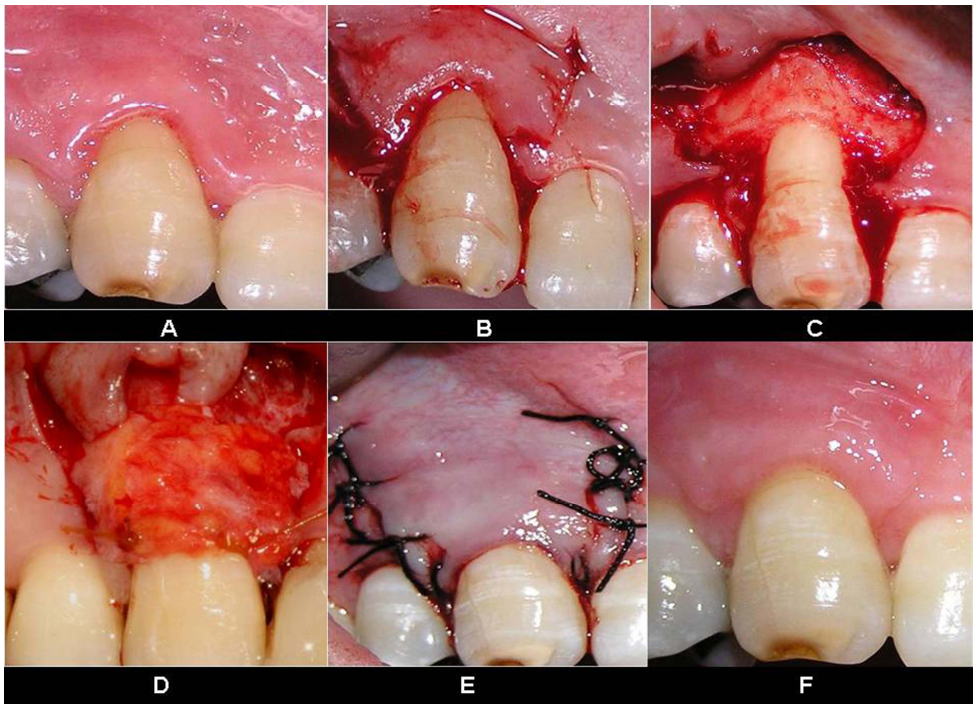

Figure 2. Root coverage procedure on the control group. (A) pre-operative clinical situation; (B) flap design; (C) flap reflection; (D) connective tissue graft secured in position; (E) final sutures and complete coverage of the graft; (F) clinical outcome at 6 month post-operative appointment.

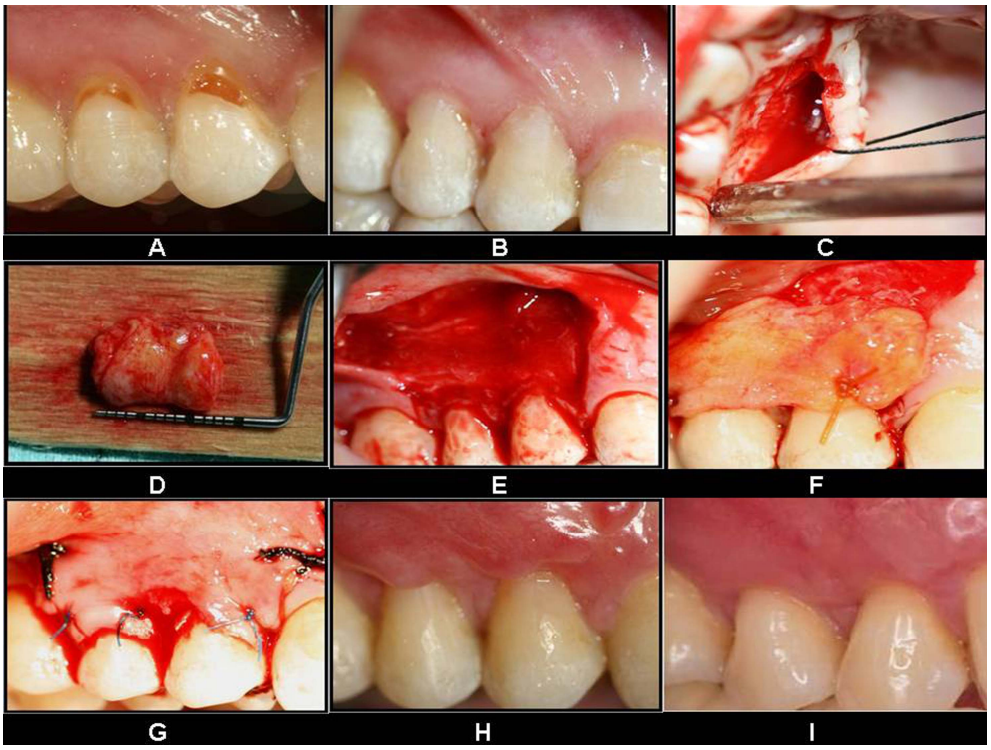

Figure 3. Clinical procedure on the test group, (A) baseline clinical situation; (B) giomer restoration on the root lesions; (C) donor site for harvesting a connective tissue graft; (D) connective tissue graft is harvested; (E) preparation of recipient site; (F) the graft is positioned; (G) the flap is coronally displaced to cover the graft as well as the defect; (H) clinical situation at 1 month post-treatment recall; (I) clinical outcome at the end of study (6 months after surgery).

Table 1. Clinical parameters of the study groups in different post-treatment intervals, data are expressed in mm (mean ±SD, n= 15 in each group).

Parameter		Baseline	1 Month	3 Month	6 Month
PD	CTG	1.00±0.33	1.17±0.36*	0.90± 0.34*	0.87±0.30*
	g-CTG	1.00±0.33	1.00±0.38*	0.70±0.25*	0.63±0.23*
KTH	CTG	3.73±0.98	3.50±0.87	3.50±0.87	3.53±0.83
	g-CTG	3.33±0.59	4.47±1.52	3.67±1.41	3.67±1.41
RW	CTG	4.50±0.50	2.20±1.06*†	2.10±1.04*†	2.10±1.04*†
	g-CTG	4.77±0.70	3.53±1.04*†	3.20±0.73*†	3.17±0.67*†
RH	CTG	3.43±0.65	0.83±0.82*	0.83±0.75*	0.87±0.72*
	g-CTG	3.73±0.53	1.20±0.70*	0.80±0.73*	0.70±0.73*
MGL	CTG	7.10±1.32	4.33±1.05*	4.36±0.92*	4.37±0.92*
	g-CTG	7.07±0.90	4.67±1.50*	4.50±1.55*	4.40±1.48*
rCAL	CTG	4.43±0.90	2.00±0.89*	1.73±0.78*	1.67±0.86*
	g-CTG	4.73±0.59	2.20±0.68*	1.47±0.67*	1.30±0.68*
RC	CTG	-	78.94±34.90*	74.43±24.72*	73.31±23.85*
	g-CTG	-	67.42±19.87*	78.30±19.96*	81.08±19.82*

*Significant difference within groups ($P < 0.05$) - Friedman's test; † significant difference between groups ($P < 0.05$) -Mann-Whitney test; PD, probing depth; KTH, keratinized tissue height; RW, recession width; RH, recession height; MGL, relative position of Mucogingival junction; rCAL, relative clinical attachment level; RC, root coverage percentage; CTG, connective tissue graft; g-CTG, giomer restoration plus connective tissue graft.

individual reference acrylic stent was used as a reference point for clinical parameters, in order to assure the reproducibility of probe positions and angulations among evaluations. Additionally, presence of visible plaque accumulation and BOP at the study sites were evaluated through the different post-operative intervals.

Statistical analysis

Descriptive statistics were recorded as mean ± standard deviation (SD). The Kolmogorov-Smirnov test was used to evaluate the homogeneity of data. Due to not being a normal distribution of data except for RC, all the parameters were analyzed by non-parametric statistical methods. To evaluate differences within groups the variables were examined by the Friedman test followed by a post-hoc non-parametric test to determine any significant differences in various post-treatment intervals. Mann-Whitney U test was carried out to evaluate differences between the groups. The significance level established for all analyses was 5% ($P < 0.05$).

RESULTS

From 21 patients, 6 patients were excluded from this study. All the 15 participants completed the study with uneventful healing at the surgical sites (15 subjects and 30 defects treated). The sites included in the surgical intervention did not show BOP or visible plaque and the subjects maintained a good standard of oral hygiene during the study period. A total of 21 out of 30 defects were Miller class II gingival recession and the remainders were Miller class I. The mean ± SD of the common clinical parameters for both groups at baseline 1, 3 and 6 months are summarized in Table 1. After 6 months, both groups showed significant changes from baseline for CAL, PD, RW and RH, but no changes in KTH.

Mean CALG from baseline achieved after 6 months were 2.76±1.37 and 3.43±0.95 mm for the control and test groups, respectively. The differences observed between the groups were not statistically significant except for recession width reduction (RWR) which was greater for the control group ($P < 0.05$). No statistically significant differences in PD, KTH, RH, CALG and RC were seen between the two study groups. The mean percentages of root coverage at the end of the study were 73.31±23.85% for control group and 81.08±19.82% for test group.

DISCUSSION

When a root exposure is associated with a cervical lesion, the cosmetic component of the surgical or restorative procedure may not be successful, especially in apically extending lesions. Therefore, to solve

problems of sensitivity and esthetics simultaneously, a combined restorative, surgical therapy is proposed for the treatment of gingival recession associated with a cervical lesion (Lucchesi et al., 2007). The combined use of a connective tissue graft with a pedicle graft is a predictable procedure to achieve root coverage (Alkan et al., 2006). In this study, the RC in the control group (73.31±23.85%) confirmed the predictability of this technique on the intact root surface. Soft tissue root coverage techniques may be contraindicated for root surfaces where the cavity preparation and/or cervical abrasion exceeds a depth of 1.0 to 3.0 mm. Procedures that move soft tissues coronally inside abraded regions may hinder the patient's plaque control and may make the restorative procedure more difficult, especially achieving a correct marginal fit and emergence profile of the restoration (Deliberador et al., 2009).

Our giomer data are in agreement with a recent case report by Alkan et al. (2006) who successfully treated a gingival recession associated with a root resorption cavity with a connective tissue graft and a resin glass-ionomer restoration.

In all the cases, even though the apical margin of restoration were subgingivally positioned after the healing period, the gingival tissue at the treated sites presented no signs of inflammation or bleeding on probing at the final evaluation. However, it is important to consider that this is a short term report that must be confirmed by longitudinal controlled clinical studies. Selection of the giomer as the restorative material was based on a previous report fluoride release, biocompatibility and smooth surface finish (Yap and Mok, 2002; Matis et al., 2004; Pourabbas et al., 2009).

In this study, shallow PDs were observed consistently in both groups at 1, 3 and 6 month intervals. These data indicated that the CAF plus CTG was associated with CALG on the restored root surfaces during the observed periods. Dragoo demonstrated histologic evidence that connective tissue and epithelium can adhere to resin ionomer when placed in a subgingival environment (Dragoo, 1997). However, further studies are required to determine whether giomer exhibit similar histological characteristics.

Initial KTH has been proposed as essential anatomical factor associated with complete root coverage in a CAF procedure (Baldi et al., 1999). Thus, KTH also was evaluated at baseline and at 1, 3 and 6 month intervals. At baseline, there were no significant differences in KTH among the groups, which demonstrated similar initial gingival tissue conditions among the groups. In addition, KTH remained unchanged 1, 3 and 6 months after surgery, suggesting that giomer may not jeopardize this gingival feature. Various factors can determine the biocompatibility of a restorative material, such as the amount and nature of leachable components and the surface structure of the final restoration (Geurtsen, 2000). Textural characterization after finishing and polishing is the major advantage of giomer that could lead to a lower plaque adherence and minimal soft tissue inflammation (Matis et al., 2004).

In this study, both groups showed root coverage improvement without damage to periodontal tissues, supporting the use of CAF plus CTG for treatment of root surfaces restored with giomer as being effective over a 6 month period. Because the true benefits for the patient are improved esthetics and the stability of the results over time, it is relevant to evaluate whether these successful outcomes remain stable. It is important to consider the patient's tooth-brushing technique for the long-term maintenance of clinical outcomes achieved by any root coverage surgical procedure (Wennström and Zucchelli, 1996). In addition, a prospective study of 26 years demonstrated that a pathogenic periodontal process may develop slowly and take 1 to 3 years to be detected clinically (Schätzle et al., 2001). Therefore, whether and to what extent these restorations will influence the periodontal tissue negatively, considering the material deterioration, must be observed in longitudinal evaluations.

ACKNOWLEDGEMENTS

The authors extend their gratitude to the Vice Chancellor for Research at Tabriz University of Medical Sciences for their financial support.

REFERENCES

Agudio G, Pini Prato G, Cortellini P, Parma S (1987). Gingival lesions caused by improper oral hygiene measures. Int. J. Periodontics. Restorative. Dent., 7(1): 52-65.

Alkan A, Keskiner I, Yuzbasioglu E (2006). Connective tissue grafting on resin ionomer in localized gingival recession. J. Periodontol., 77(8): 1446-1451.

Baldi C, Pini-Prato G, Pagliaro U, Nieri M, Saletta D, Muzzi L, Cortellini P (1999). Coronally advanced flap procedure for root coverage. Is flap thickness a relevant predictor to achieve root coverage? A 19-case series. J. Periodontol., 70(9): 1077-1084.

Buckley LA (1981). The relationships between malocclusion, gingival inflammation, plaque and calculus. J. Periodontol., 52(1): 35-40.

Contreras A, Slots J (1998). Active cytomegalovirus infection in human periodontitis. Oral. Microbiol. Immunol., 13(4): 225-230.

Deliberador TM, Bosco AF, Martins TM, Nagata MJ (2009). Treatment of gingival recessions associated to cervical abrasion lesions with subepithelial connective tissue graft: a case report. Eur. J. Dent., 3(4): 318-323.

Donaldson D (1973). Gingival recession associated with temporary crowns. J. Periodontol., 44(11): 691-696.

Dragoo MR (1997). Resin-ionomer and hybrid-ionomer cements: part II, human clinical and histologic wound healing responses in specific periodontal lesions. Int. J. Periodontics. Restorative. Dent., 17(1): 75-87.

Geurtsen W (2000). Biocompatibility of resin-modified filling materials. Crit. Rev. Oral. Biol. Med., 11(3): 333-355.

Kassab MM, Cohen RE (2003). The etiology and prevalence of gingival recession. J. Am. Dent. Assoc., 134(2): 220-225.

Lucchesi JA, Santos VR, Amaral CM, Peruzzo DC, Duarte PM (2007). Coronally positioned flap for treatment of restored root surfaces: a 6-month clinical evaluation. J. Periodontol., 78(4): 615-623.

Matis BA, Cochran MJ, Carlson TJ, Guba C, Eckert GJ (2004). A three-year clinical evaluation of two dentin bonding agents. J. Am. Dent.

Assoc., 135(4): 451-457.
Pourabbas R, Farajnia S, Kimyai S, Mohammadnejad L, Johnson A, Nejatian T (2009). In vitro assessment of cytotoxicity of giomer on human gingival fibroblasts. Afr. J. Biotechnol., 8(20): 5522-5526.
Sauro S, Mannocci F, Watson TF, Piemontese M, Sherriff M, Mongiorgi R (2007). The influence of soft acidic drinks in exposing dentinal tubules after non-surgical periodontal treatment: a SEM investigation on the protective effects of oxalate-containing phytocomplex. Med. Oral. Patol. Oral. Cir. Bucal., 12(7): 542-548.
Schätzle M, Land NP, Anerud A, Boysen H, Bürgin W, Löe H (2001). The influence of margins of restorations of the periodontal tissues over 26 years. J. Clin. Periodontol., 28(1): 57-64.
Serino G, Wennström JL, Lindhe J, Eneroth L (1994). The prevalence and distribution of gingival recession in subjects with a high standard of oral hygiene. J. Clin. Periodontol., 21(1): 57-63.
Trossello VK, Gianelly AA (1979). Orthodontic treatment and periodontal status. J. Periodontol., 50(12): 665-671.
Wennström JL, Zucchelli G (1996). Increased gingival dimensions. A significant factor for successful outcome of root coverage procedures? A 2-year prospective clinical study. J. Clin. Periodontol., 23(8): 770-777.
Yap AU, Mok BY (2002). Surface finish of a new hybrid aesthetic restorative material. Oper. Dent., 27(2): 161-166.
Zucchelli G, Amore C, Sforzal NM, Montebugnoli L, De Sanctis M (2003). Bilaminar techniques for the treatment of recession-type defects. A comparative clinical study. J. Clin. Periodontol., 30(10): 862-870.