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Clinical and periodontal predictive factors of severity in gingival recession (GR)

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Abstract

Introduction: *Gingival recession is an unsightly condition due to root exposure. It can lead to dental hypersensitivity, root caries, and tooth loss.* **Objective:** *To determine the influence of different clinical and periodontal parameters on the severity of gingival recession evaluated at four periods: initial, 6, 12, and 18 months of follow-up.* **Material and Methods:** *Forty patients with gingival recession were included in the study. Sociodemographic data, systemic diseases, harmful habits, dental hygiene habits, parafunctional habits, and orthodontic treatment were collected. Periodontal status (plaque index, gingival bleeding index, attached gingiva loss, pocket probing depth, and attachment loss) was also measured.* **Results:** *None of the clinical parameters studied influenced the number of teeth with gingival recession. Smokers showed a higher number of teeth with attached gingiva loss (p = 0.03). A direct relationship between the severity of gingival recession and plaque index (p = 0.02) or 4-6 mm attachment loss (p = 0.04) was observed. At six months of follow-up, gingival index was the only parameter that influenced the severity of gingival recession (p = 0.01).* (Gac Med Mex. 2016;152:44-50)

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KEY WORDS: *Plaque index. Bleeding index. Probing depth. Gingival recession.*

Introduction

Gingival recession (GR) is the displacement of the gingival margin, apical to the cementoenamel junction, with exposure of the root surface. GR can be localized o generalized and be associated with one or more surfaces[1]. GR is an unsightly condition that can lead to dental hypersensitivity, root caries and, ultimately, tooth loss.

The most widely used GR classification is the one by Miller[2], which considers four classes according to the recession extent.

The appearance and severity of GR can be determined by different factors, such as age, sex, systemic diseases, consumption of drugs, noxious habits (tobacco and alcohol consumption), and inadequate dental hygiene, parafunctional habits or use of oral piercings[3].

With regard to age, different studies[4-6] reveal that, as it advances, GR prevalence and severity increase. As for sex, in population groups of the same age, GR affects more the male than the female gender[4,5].

Dental hygiene habits can play an important role in the etiology of GR, especially considering the brushing frequency and technique, the type of brush and the hardness of its bristles, together with the use of dental floss and/or mouthwashes. However, GR in people with good dental hygiene has been shown to affect more oral than proximal or lingual surfaces[7-9]. Some studies[5,10] establish a direct correlation between GR and the frequency of tooth brushing.

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Orthodontics treatments have been frequently associated with the appearance of GR[11,12], but there are no clear evidences that support this association, since there are studies failing to find it[13,14].

The main treatment option for GR is sub-epithelial connective tissue grafting, which achieves a predictable root coverage with high cosmetic level[15,16]. There are also other techniques, such as epithelial free gingival grafts, pediculated flaps or treatments with guided tissue regeneration[17].

The purpose of this study was to determine the influence of different clinical and periodontal parameters on the severity and evolution of GR as assessed at the baseline of the study and at 6, 12 and 18 months.

Material and methods

The sample of this study was comprised by 40 patients with GR attending a private odontology center to receive treatment. There were 30 females (75%) and 10 males (25%), with ages ranging from 16 to 73 years (mean: 39.08 ± 12.40 years). Patients with generalized GR as a consequence of periodontal conditions and oral piercing-bearers were excluded from the study.

Prior to examination, each patient was provided the necessary information on the purposes of the work in order to obtain his/her consent. All the obtained information was incorporated into a clinical record especially designed for this purpose. The study protocol was approved by the Universidad de Granada Odontology Faculty Human Research Ethics Committee (ref. FOD-UGR-031/2014). All patients were examined and diagnosed by the same operator.

The study patients were assessed at four different periods: at the baseline of the study and at 6, 12 and 18 months.

At first visit, each patient was applied a questionnaire that included data on his/her medical history: prior systemic diseases, tobacco and/or alcohol consumption, tooth-brushing frequency, brushing technique, toothbrush bristles hardness, use of mouthwash and dental floss, other oral habits and previous dental treatments, with special reference to orthodontics.

The number of teeth with GR was determined. GR was obtained by considering the distance between the cementoenamel junction and the upper edge of the gum. The GR grade was established following the Miller classification[2], which considers four classes:

- Class I: marginal tissue recession that does not reach the mucogingival junction.
- Class II: recession that extends to or beyond the mucogingival junction with no periodontal insertion (bone or soft tissue) loss in the interdental area.
- Class III: recession that extends to or beyond the mucogingival junction with periodontal attachment loss in the interdental area with malpositioning of the teeth.
- Class IV: marginal tissue recession that extends to or goes beyond the mucogingival junction with severe bone or soft tissue loss in the interdental area and/or severe malpositioning of the teeth.

Furthermore, the periodontal state of the patients was assessed considering the plaque index, the gingival bleeding index, the number of teeth with attached gum loss, the periodontal pocket probing depth and attachment loss. All these measurements were performed using sterile periodontal probes of the HU-FriedyCP11™ type (Hu-FriedyMfg. B.V., the Netherlands).

Once the plaque was visualized by disclosure with erythrosine staining, the O'Leary index[18] was used to enable the assessment of the plaque index, which evaluates the presence or absence of plaque, i.e., the number of dental surfaces covered by bacterial plaque. The gingival bleeding index is recorded by probing the gingival sulcus depth and writing down the presence or absence of bleeding 30 s after the probing. In both indices, 4 dental surfaces are assessed by tooth: vestibular, lingual/palatal, mesial and distal.

The attached gingiva loss was also determined, which is obtained by subtracting the gingival sulcus depth from the distance existing between the edge of the gingiva and the mucogingival junction.

The probing depth was estimated by measuring the distance between the upper edge of the gingiva and the bottom of the periodontal pocket. Attachment loss was obtained by considering the distance between the cementoenamel junction of the tooth and the bottom of the periodontal pocket, i.e., by adding the two previous measurements (attachment loss = gingival recession + probing depth). For each tooth, 6 measurements were recorded, 3 vestibular and 3 lingual, corresponding to each tooth's mesial, medial and distal localizations. These measurements are differentiated in sectors: between 1 and 3 mm, from 4 to 6 mm and more than 6 mm.

All patients were instructed on buccodental hygiene techniques adapted to their conditions and risk factors. They were instructed to perform the brushing thrice-daily, with adequate technique and toothbrushes, with

Table 1. Main characteristics observed in the study population (n = 40)

Parameter	n (%)
Systemic diseases	
Yes	7 (17.5%)
No	33 (82.5%)
Smoking habit	
Yes	15 (37.5%)
No	25 (62.5%)
Brushing frequency	
Doesn't brush	1 (2.5%)
1 time/day	6 (15.0%)
2 times/day	9 (22.5%)
3 or more times/day	24 (60.0%)
Brushing technique	
Doesn't brush	1 (2.5%)
Vertical	20 (50.0%)
Horizontal	12 (30.0%)
Circular	4 (10.0%)
Electric	3 (7.5%)
Toothbrush hardness	
Doesn't use	1 (2.5%)
Sensitive	9 (22.5%)
Soft	6 (15.0%)
Medium	19 (47.5%)
Hard	2 (5.0%)
Periodontal	5 (7.5%)
Use of dental floss	
Yes	21 (52.5%)
No	19 (47.5%)
Use of mouthwash	
Yes	11 (27.5%)
No	29 (72.5%)
Orthodontics treatment	
Yes	6 (15.0%)
No	34 (85.0%)

additional interproximal brushing techniques used at least once-daily. In some cases, the patients were trained on the use of electric toothbrush to avoid excessive force pressures.

Descriptive statistics (arithmetical mean, standard deviation and percentages) and analytical statistics (Students t-test, ANOVA, chi-square test and Fisher exact test) were used for the comparison of variables. A p-value < 0.05 was considered as the minimum level of significance. The data were processed using the SPSS version 15.0.1 software for Windows (Statistical Package for the Social Sciences; SPSS Inc., Chicago, Illinois, USA).

Results

The most relevant characteristics of the 40 studied patients are shown in table 1.

The teeth with a higher frequency of GR were the mandibular central left incisor (8.3%), the first mandibular left premolar (7.6%) and the mandibular central and lateral left incisors (6.8% on both cases). The patients had a mean number of 3.30 teeth with GR, with a range between 1 and 16 teeth. The number of teeth with recession was not influenced by the following parameters: age (p = 0.19), gender (p = 0.84), smoking habit (p = 0.83), presence of systemic disease (p = 0.30), tooth brushing frequency (p = 0.35), brushing technique (p = 0.46), toothbrush bristle hardness (p = 0.61), use of dental floss (p = 0.85), use of mouthwash (p = 0.61), existing parafunctional habits (p = 0.91) and orthodontics treatment (p = 0.07).

One of the factors most strongly associated with GR is gingival attachment loss. In this study, the number of teeth with attached gingiva loss was 0.85, with a range varying from 0 to 12 teeth. Similar to what occurs in recession, the following parameters did not influence on attached gingiva loss: age (p = 0.34), gender (p = 0.30), existing systemic disease (p = 0.43), brushing frequency (p = 0.11), brushing technique (p = 0.16), toothbrush bristle hardness (0.47), use of dental floss (p = 0.19), use of mouthwash (p = 0.15), existing parafunctional habits (p = 0.90) and orthodontics treatment (p = 0.98). Conversely, the smoking habit did determine attached gingiva loss, and a larger number of teeth with loss was observed among smokers (p = 0.03).

As for GR severity (Table 2), at baseline, 15 patients (37.5%) had type I recessions and 25 (62.5%), type II. No patient had Miller type III or IV recessions. At six months of follow-up, 14 (35%) patients had type I recessions, 21 (52.5%), type II, and 5 (12.5%), type III. At 12 and 18-month's follow-up, GR severity did not vary and these data remained unchanged.

At the baseline of the study (Table 3), the GR severity degree was determined by the plaque index (higher plaque percentages were observed in patients with more serious recession [p = 0.02]) and by 4-6 mm attachment loss, also higher in patients with more serious recession (p = 0.04). The remaining parameters (age, gingival bleeding index, mean number of teeth with GR, mean number of teeth with attached gingiva loss, 1-3 mm probing depth, probing depth greater than 6 mm, 1-3 mm attachment loss and attachment loss greater than 6 mm) did not influence on the GR severity degree.

Table 2. GR severity evolution over the 4 study periods

GR*	Baseline n (%)	At 6 months n (%)	At 12 months n (%)	At 18 months n (%)
Class I	15 (37.5%)	14 (35.0%)	14 (35.0%)	14 (35.0%)
Class II	25 (62.5%)	21 (52.5%)	21 (52.5%)	21 (52.5%)
Class III	0 (0%)	5 (12.5%)	5 (12.5%)	5 (12.5%)
Class IV	0 (0%)	0 (0%)	0 (0%)	0 (0%)

*According to Miller's classification.

Table 3. Inventory of analyzed parameters with GR severity degree at baseline

	GR*		
Parameter	Class I	Class II	Level of significance
Age (years)	35.73 ± 6.29	41.08 ± 14.69	p = 0.19
Plaque index (%)	25.00 ± 4.03	28.48 ± 4.91	p = 0.02†
Gingival bleeding index (%)	10.40 ± 2.79	11.60 ± 4.41	p = 0.35
Number of teeth with GR	3.73 ± 4.71	3.04 ± 3.31	p = 0.58
Number of teeth with attached gingiva loss	0.13 ± 0.35	1.28 ± 2.45	p = 0.08
1-3 mm probing depth (%)	97.47 ± 4.10	94.60 ± 5.28	p = 0.08
4-6 mm probing depth (%)	2.53 ± 4.10	5.08 ± 4.73	p = 0.09
> 6 mm probing depth (%)	0.00 ± 0.00	0.32 ± 0.94	p = 0.20
1-3 mm attachment loss (%)	96.67 ± 3.33	93.48 ± 5.86	p = 0.06
4-6 mm attachment loss (%)	3.20 ± 3.07	6.00 ± 4.77	p = 0.04†
> 6 mm attachment loss (%)	0.13 ± 0.51	0.64 ± 1.80	p = 0.29

*According to Miller's classification.
†Statistically significant.

At 6-month-follow-up (Table 4), age, plaque index, 1-3 mm probing depth, 4-6 mm probing depth, probing depth greater than 6 mm, 1-3 mm attachment loss, 4-6 mm attachment loss and attachment loss greater than 6 mm, did not influence on GR severity degree. Gingival bleeding was the only parameter that influenced on GR severity degree, with higher percentages found as severity increased (p = 0.01).

At 12 (Table 5) and 18 months' follow-up (Table 6), none of the following parameters influenced on GR degree of severity: age, plaque index, gingival bleeding index, 1-3 mm probing depth, 4-6 mm probing depth, probing depth greater than 6 mm, 1-3 mm attachment loss, 4-6 mm attachment loss and attachment loss larger greater 6 mm.

Discussion

GR is a common condition that produces exposure of the root surface and loss of dental supportive tissue. Many patients show concerns about bad esthetics, dental hypersensitivity and fear of tooth loss[19].

It is a quite frequent oral problem that affects 88% of subjects older than 65 years and almost half the population aged between 18 and 64 years. GR frequency and severity increase with age. The factors more frequently associated with GR include the traumatic action of brushing, gender, malpositioned teeth, gingivitis and tobacco consumption. GR appears both in subjects with good and poor oral hygiene. GR has a multifactorial etiology, with anatomical, physiological and pathological factors involved. Recession is more common in oral or vestibular teeth surfaces[20].

Many factors have been proposed as influencing on the development of marginal tissue recession and there is controversy on the concept of an adequate zone of gingival attachment[21]. Currently, the dimensions of the different parts of the masticatory mucosa have become a topic of considerable interest in periodontics from the epidemiological and therapeutic

Table 4. Inventory of analyzed parameters with GR severity degree at 6-month-follow-up

	GR*			
Parameter	**Class I**	**Class II**	**Class III**	**Level of significance**
Age (years)	36.36 ± 6.03	41.67 ± 15.56	35.80 ± 9.95	p = 0.39
Plaque index (%)	23.50 ± 4.05	26.10 ± 3.46	26.80 ± 2.95	p = 0.08
Gingival bleeding index (%)	8.93 ± 3.14	10.43 ± 3.61	14.80 ± 4.60	p = 0.01†
1-3 mm probing depth (%)	94.86 ± 5.85	92.38 ± 5.50	94.80 ± 4.60	p = 0.38
4-6 mm probing depth (%)	5.14 ± 5.85	7.33 ± 5.15	4.80 ± 3.89	p = 0.40
> 6 mm probing depth (%)	0.00 ± 0.00	0.29 ± 0.71	0.40 ± 0.89	p = 0.29
1-3 mm attachment loss (%)	94.93 ± 4.99	92.62 ± 5.04	94.80 ± 4.60	p = 0.36
4-6 mm attachment loss (%)	5.07 ± 4.99	7.10 ± 4.73	4.80 ± 3.89	p = 0.38
> 6 mm attachment loss (%)	0.00 ± 0.00	0.29 ± 0.71	0.40 ± 0.89	p = 0.08

*According to Miller's classification.
†Statistically significant.

Table 5. Inventory of analyzed parameters with GR severity degree at 12-month-follow-up

	GR*			
Parameter	**Class I**	**Class II**	**Class III**	**Level of significance**
Age (years)	36.36 ± 6.03	41.67 ± 15.56	35.80 ± 9.95	p = 0.39
Plaque index (%)	29.64 ± 4.58	29.05 ± 5.39	30.00 ± 3.53	p = 0.89
Gingival bleeding index (%)	13.64 ± 4.08	11.81 ± 3.88	13.20 ± 6.41	p = 0.45
1-3 mm probing depth (%)	96.64 ± 4.36	94.29 ± 5.12	97.20 ± 4.38	p = 0.26
4-6 mm probing depth (%)	3.21 ± 4.08	5.29 ± 4.69	2.80 ± 4.38	p = 0.30
> 6 mm probing depth (%)	0.14 ± 0.53	0.43 ± 0.81	0.00 ± 0.00	p = 0.30
1-3 mm attachment loss (%)	95.07 ± 4.93	92.67 ± 4.95	95.20 ± 4.81	p = 0.30
4-6 mm attachment loss (%)	4.93 ± 4.93	7.05 ± 4.63	4.80 ± 4.81	p = 0.37
> 6 mm attachment loss (%)	0.00 ± 0.00	0.29 ± 0.95	0.00 ± 0.00	p = 0.44

*According to Miller's classification.

point of view. The masticatory mucosa thickness[22] influences on the development of GR and facilitates the performance of root coverage treatments with grafts, etc.

In the present work, the teeth that showed higher GR prevalence were the mandibular central left incisor (8.3%), the mandibular first left premolar (7.6%) and the mandibular central and lateral right incisors (6.8% on both cases). However, there is no consensus in the literature with regard to which teeth are the most affected by GR. In the study by Humagain et al.[23], carried out in rural Nepalese population, mandibular central incisors were the teeth that displayed GR more frequently (7.3%), followed by the mandibular lateral incisors and the maxillary and mandibular first molars. Chrysanthakopoulos[10], in a study carried out in the Greek population, found that the most affected teeth were the maxillary first molar (20.5%), the mandibular first molar (15.8%) and the maxillary second molar (14.8%). Marini et al.[24], in the examination of a group of patients attending to receive treatment in a Brazilian odontology faculty, found that the teeth more frequently showing recession were the mandibular lateral incisors, the mandibular premolars and the maxillary first molars and premolars. Some studies[25,26] indicate that maxillary canines and premolars are the most affected teeth; others[27,28], the maxillary molars and premolars, and one study[29] establishes that the maxillary central incisors and first molars are.

Classically, the prevalence, extent and severity of GR have been associated with age and gender[30,31].

Table 6. Inventory of analyzed parameters with GR severity degree at 18-month-follow-up

	GR*			
Parameter	**Class I**	**Class II**	**Class III**	**Level of significance**
Age (years)	36.36 ± 6.03	41.67 ± 15.56	35.80 ± 9.95	p = 0.39
Plaque index (%)	28.79 ± 5.10	29.00 ± 4.33	28.40 ± 5.03	p = 0.96
Gingival bleeding index (%)	14.07 ± 2.36	11.29 ± 3.97	11.60 ± 5.94	p = 0.10
1-3 mm probing depth (%)	97.00 ± 3.96	94.48 ± 5.05	97.20 ± 4.38	p = 0.22
4-6 mm probing depth (%)	3.00 ± 3.96	5.14 ± 4.54	2.80 ± 4.32	p = 0.28
> 6 mm probing depth (%)	0.00 ± 0.00	0.38 ± 0.80	0.00 ± 0.00	p = 0.14
1-3 mm attachment loss (%)	95.14 ± 5.30	92.81 ± 4.89	94.80 ± 5.40	p = 0.38
4-6 mm attachment loss (%)	4.86 ± 5.30	7.10 ± 4.77	4.80 ± 4.81	p = 0.36
> 6 mm attachment loss (%)	0.00 ± 0.00	0.10 ± 0.43	0.40 ± 0.89	p = 0.22

*According to Miller's classification.

Thus, older age and male gender are two determining factors for the appearance of GR. A higher number of teeth with GR have also been observed in individuals of low socioeconomic level, with poor oral hygiene and in smokers. Similarly, other works[20,32] associate the prevalence of GR with traumatic agents, gender, malpositioned teeth, gingivitis and tobacco consumption.

In contrast to these studies, in our work, age, gender or the habit of smoking did not influence on the frequency or severity of recession. This fact is probably determined by the sample size and the characteristics of the population.

One of the factors most strongly associated with GR is the loss of attached gingiva. Lang and Löe[33] determined the minimum amount of attached gingiva consistent with gingival health: they suggested that a minimum of 2 mm was required to maintain adequate health. Nevertheless, more recent studies[34] demonstrate that GR is not higher in teeth with little attached gingiva.

There is no basic rule that allows establishing the attached gingiva minimum amount, but the factors determining the appearance of GR are other, such as bacterial plaque or tobacco consumption[5].

Tobacco consumption can negatively influence both on the reduction of GR and on the level of clinical attachment gain when GR is treated[35]. In our study, no factor did determine the loss of attached gingiva, except for tobacco consumption. Smoker patients showed a higher number of teeth with attached gingiva loss (p = 0.03).

The traumatic action of tooth brushing has been widely associated with the occurrence of GR, and the frequency, the brushing technique and hardness of the toothbrush bristles are considered determining factors for the occurrence of recession[36-38].

However, Litonjua et al.[39] conducted a systematic review on the influence of tooth brushing on recession and obtained inconclusive results that didn't allow for a direct relationship between both events to be established. According to these authors, tooth brushing frequency and technique, as well as hardness of the toothbrush bristles are factors not affecting GR (p > 0.05 for all cases).

Matas et al.[19] carried out a 10-year follow up study of 40 last-year odontology students with GR and detected an increase in the number of teeth with GR and its severity associated with the plaque index and periodontal disease worsening. This fact highlights the failure of oral and dental hygiene measures in this population group. Other studies[40] coincide in pointing out dental plaque as one of GR precipitating factors.

According to the findings of our work, plaque index (p = 0.02) and attachment loss between 4 and 6 mm (p = 0.04) were the factors that determined the GR severity degree at baseline. At 6-months' follow-up, gingival bleeding index (p = 0.01) was the only parameter influencing on the severity of recession. The measures of plaque control and oral and dental hygiene are fundamental in the supportive treatment of GR.

In the particular case of orthodontics treatments that classically have been associated with GR[41], there is

currently great controversy on the possible association of orthodontics treatment and GR, and a relatively weak level of evidence is observed in this regard. Richman[42] looked into the possible impact of orthodontic treatment on GR and indicated that, by itself, it doesn't induce the development of GR, but its appearance is related to the way orthodontic treatments are executed. In our work, we did not observe any relationship between the appearance of GR and orthodontics treatments.

In the present study, the plaque index, attachment loss and the gingival bleeding index were the parameters with the highest influence on the severity of GR. However, further studies are required in larger population groups and in different zones of the world in order to establish the true influence of all these factors on GR.

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