

Effects of Manual Toothbrushing on Gingival Recession in an Adult Population Sample in South of Chile

Efectos del Cepillado de Dientes Manual sobre la Recesión Gingival en una Muestra de Población Adulta en el Sur de Chile

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ABSTRACT: The aim was to study the association between the presence of gingival recession (GR) and manual brushing features in an adult population in southern Chile. A study on a probabilistic stratified random sample of 530 teeth with GR in 105 patients (75 women and 30 men), distributed in 3 age groups (18-34, 35-50 and 51-64 years), who used manual brushing the last 10 years were performed. Three examiners ($k=0.87$) evaluated the brush type, frequency and method of brushing. We recorded the GR depth and width as rated Miller's classification, sulcus or pocket depth, clinical attachment loss (CAL), tooth malposition and the presence or absence of gingival bleeding on probing. The GR were 28.68% class I, 35.47% class II, 29.24% Class III and 6.61% Class IV. First and second mandibular premolar showed the highest GR frequency. Combined brushing method and medium toothbrush type were the most used. Significant differences between GR and brushing frequency ($p = 0.001$); 64.1% of teeth relate GR to brushing frequency of 3 or more times daily. CAL of 3-4 mm was associated with GR ($P=0.000$), affecting 60.3% of teeth. In addition, gingival bleeding and tooth malposition were associated with a higher frequency of GR. Brushing frequency of 3 or more times daily is associated with the presence of GR.

KEY WORDS: gingival recession, toothbrush type, toothbrushing technique, toothbrushing frequency.

INTRODUCTION

Gingival recession (GR) has become a common problem for periodontics in recent years. The treatment aims to reduce tooth sensitivity and improve aesthetics. Acquired type factors, development of rash and congenital contribute to produce a GR. Among the factors acquired by the patient, include brushing, parafunctional habits, snuff consumption and poor hygiene. The development and eruption factors are related to the pattern of tooth eruption and its location in the arch while congenital factors are directly related to genetic and morphological status of the patient, specifically the periodontal biotype. According to the relationship of these factors may be one or more teeth with GR.

It is important to detect the presence and GR type (Beltrán *et al.*, 2013), commonly categorized by Miller's classification (1985), and then diagnose the source or cause for the purpose of removing and treating effect. In a proper periodontal evaluation, the presence and characteristics of all GR must be registered, and factors that may have an influence on its development. These can therefore be treated with a high probability of success.

It has been reported that poor oral hygiene and abrasive brushing are cause or risk factors that favor the GR (Saxer, 1999). According Chrysanthakopoulos *et al.* (2011), there is a correlation between the

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prevalence of GR and brushing method and type used in adult subjects. In South America, prevalence about 80% in GR has been described (Susin *et al.*, 2004; Maetahara, 2006; Segovia *et al.*, 2002), but studies have not necessarily associated variables such as brush type, brushing technique or frequency of brushing. In Chile, a high prevalence of GR in young adults in Concepcion has been described (Wilckens *et al.*, 2003). Nationally, although the first Chilean national dental examination survey data show important cities like Temuco, there no related information about GR and brush type, brushing method and frequency of brushing.

The aim of this study was to associate the presence of GR with manual brushing characteristics in a population of adult patients in southern Chile.

MATERIAL Y METHOD

Sampling and sample size. A stratified, multi-stage probability design study on a population of southern Chile was carried out, and included records from public health services, clinics in Temuco and the clinic of the Faculty of Dentistry, University of La Frontera, Chile. The population was distributed in 3 cutting ages: young adults, aged between 18-34 years, adults, aged between 35-50 years and seniors adults, aged between 51-64 years. Population sample subdivision was performed to allow a better precision in the estimates.

The study subjects were randomly selected from different areas of Temuco, administrative capital of the Araucania region in southern Chile (samples of the urban population). The random sample included 530 teeth with GR in 105 patients (75 women and 30 men) who had at least 16 natural teeth present in the mouth, all with good systemic health, with or without periodontal disease, following the methodology of epidemiological studies of the WHO (World Health Organization, 1997).

Study Subjects. Users of public clinics and clinic of the Faculty of Dentistry, University of La Frontera, Temuco, Chile, administrative capital of the Araucania region of 300 000 inhabitants. Participants were contacted from the databases of the respective services, and said to be conveniently evaluated. All participants were informed about the assessment and gave informed consent to participate in the study. The study included subjects who had used any manual toothbrush for the past 10 years and who had received at least once instruction regarding the method of brushing. We excluded subjects with

uncontrolled systemic disease, or with any type of syndrome affecting the oral cavity, and those under 18 or over 65 years.

Evaluation. Initially, we performed a calibration and training of examiners for three successive days with groups of 10 patients. All tests were repeated until an acceptable measurement consistency was obtained, determined by intraclass correlation coefficient. This gave a result of 0.87 k statistics, the reliability of the examiners was considered a range from good to excellent. Validity and reliability tests were conducted during the beginning middle and end of the study ranges from 0.85 to 0.90.

Subsequently, we conducted a questionnaire with each participant (age, sex, type of manual toothbrush, frequency of brushing, and brushing method) while one of the examiners performed the clinical evaluation. For measurement of GR in vertical and horizontal was used a 15 mm probe (North Carolina) based on the Miller's classification. Records were obtained: depth and breadth of the recession, sulcus or pocket depth, clinical attachment loss (CAL), malposition of the affected tooth and presence or absence of gingival bleeding on probing on the buccal surfaces of all teeth affected. In cases where the CEJ was covered in tartar (calculus) or hidden by a restoration, tooth wear cervical injury, the location of the junction was estimated on the basis of the adjacent tooth.

Statistical analysis. Categorical and quantitative values were presented as absolute frequencies and percentages observed. Data were stratified according to age groups, periodontal values, dental malposition and hygiene, analyzed through Chi square test and univariate analysis. The data analysis was performed using SPSS 11.5 statistical software (SPSS Inc., Chicago, IL, USA). The contribution of each variable in the model was evaluated to determine the influence of variables such as age, sex, oral hygiene habits and periodontal values. Statistical significance was defined at $P < 0.05$.

RESULTS

All teeth showed GR, where 152 were class I (28.68%), 188 (35.47%) class II, 155 (29.24%) class III and 35 (6.61%) class IV, according with Miller's classification. There was a thick periodontal biotype associated with 64.53% of the sites showed recession and 35.47% of the sites were associated with a thin biotype. More recession teeth were observed in the mandible (Fig. 1).

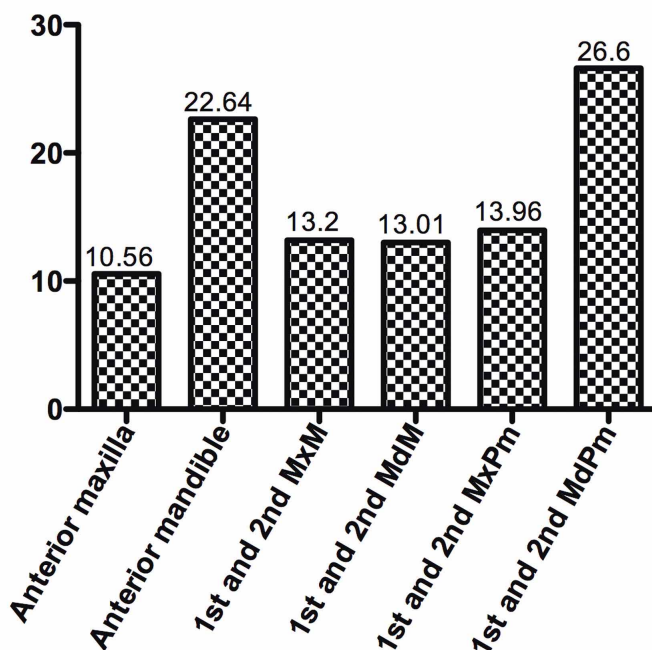


Table I. Frequency of the variables considered for this study grouped according to age groups and sex.

In relation to the age where GR were observed, in ranges between 18 to 34 years were 116 teeth (21%), between 35 to 50 years 302 teeth (57%) and between 51 to 64 years 112 teeth (22%). The frequency of the variables considered for this study as type of brush, brushing technique, tooth brushing frequency, dental malposition, gingival bleeding and CAL in relation to age groups are shown in Table I.

As for the method for brushing teeth and toothbrush type, the combined method and the use of manual brush were the variables that showed a higher frequency of GR of all analyzed teeth. Statistical analysis showed significant differences between the frequency of brushing and GR ($p=0.001$), where there is no significant difference between the type of toothbrush and brushing technique with gingival GR (Fig. 2). The brushing technique less associated with GR was horizontal (1.1%, Fig. 2), in contrast to the combined technique (60.6%) which was mostly associated with GR of the total affected teeth. Additionally, we note that 64.1% of the affected

Fig. 1. Distribution of gingival recession by tooth type in total sample. MxM= Maxillary molars, MdM= Mandibular molars, MxPm= Maxillary Premolars, MdPm= Mandibular Premolars

Variable	18 to 34 years		35 to 50 years		51 to 64 years		Total	
	Female	Male	Female	Male	Female	Male	Female	Male
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age	74 (63.4)	42 (36.6)	218 (72.2)	84 (27.8)	84 (75)	28 (25)	376 (70.9)	154 (29.1)
Toothbrush type								
Soft	20 (87)	3 (13)	83 (84.7)	15 (15.3)	11 (52.4)	10 (47.6)	114 (80.28)	28 (19.72)
Medium	36 (65.6)	19 (34.5)	96 (62.3)	58 (37.7)	58 (100)	0 (0)	190 (71.16)	77 (28.83)
Hard	18 (47.4)	20 (52.6)	39 (78)	11 (22)	15 (45.5)	18 (54.5)	72 (59.5)	49 (40.5)
Toothbrushing technique								
Combined	20 (64.5)	11 (35.5)	123 (67.2)	60 (32.8)	0 (0)	0 (0)	143 (66.82)	71 (33.18)
Horizontal	2 (100)	0 (0)	4 (100)	0 (0)	5 (100)	0 (0)	11 (100)	0 (0)
Vertical	52 (62.7)	31 (37.3)	91 (79.1)	24 (20.9)	79 (73.8)	28 (26.2)	222 (72.79)	83 (27.21)
Toothbrushing frequency								
Three or more	37 (62.7)	22 (37.3)	147 (75.8)	47 (24.2)	65 (74.7)	22 (25.3)	249 (73.24)	91 (26.76)
Two	28 (66.7)	14 (33.3)	67 (77)	20 (23)	19 (76)	6 (24)	114 (74.02)	40 (25.98)
One	9 (60)	6 (40)	4 (19)	17 (81)	0 (0)	0 (0)	0 (0)	0 (0)
Tooth Position								
Normal	71 (64.5)	39 (35.5)	203 (72.5)	77 (27.5)	74 (73.3)	27 (26.7)	348 (70.88)	143 (29.12)
Anormal	3 (50)	3 (50)	15 (68.2)	7 (31.8)	10 (90.9)	1 9.1	28 (71.79)	11 (28.21)
Hemorrhagic								
Positive	53 (58.2)	38 (41.8)	186 (72.1)	72 (27.9)	82 (82)	18 (18)	321 (71.49)	128 (28.51)
Negative	21 (84)	4 (16)	32 (72.7)	12 (27.3)	2 (16.7)	10 (83.3)	55 (67.9)	26 (21.1)
Percent of teeth with clinical attachment loss								
0 to 2 mm	10 (71.4)	4 (28.6)	15 (71.4)	6 (28.6)	0 (0)	0 (0)	25 (71.43)	10 (28.57)
3 to 4 mm	47 (59.5)	32 (40.5)	151 (78.6)	41 (21.4)	36 (80)	9 (20)	234 (74.05)	82 (25.95)
5 or more mm	17 (73.9)	6 (26.1)	52 (58.4)	37 (41.6)	48 (71.6)	19 (28.4)	117 (65.36)	62 (34.64)

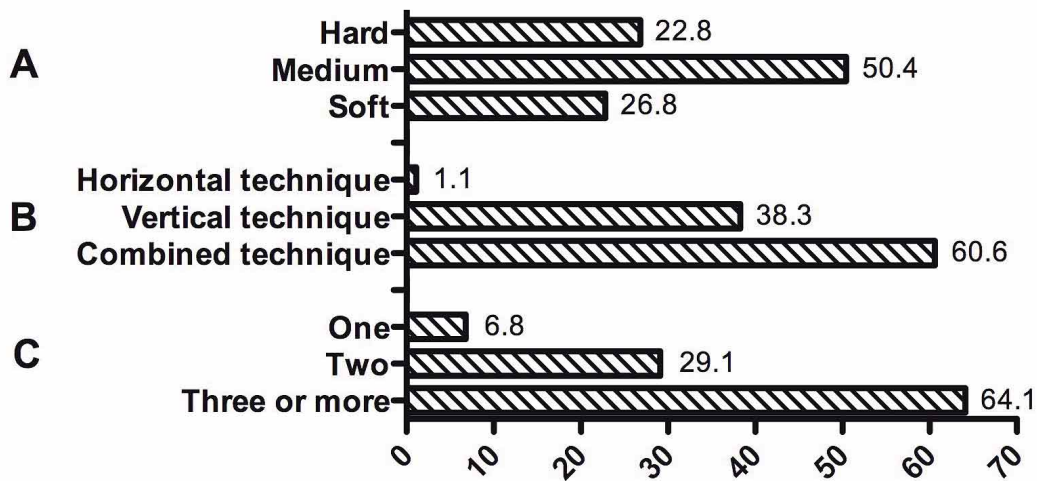


Fig. 2. Distribution of the recession by type of toothbrush (A), brushing technique (B) and brushing frequency per day (C).

teeth is related to brushing frequency of 3 or more times a day (Fig. 2).

CAL more strongly associated with gingival recession was 3-4 mm, corresponding to 60.3% of the affected teeth, and less frequently between 0-2 mm CAL. The insertion loss greater than or equal to 5 mm

accounted for 33.9% of teeth affected (Fig. 3). According to statistical analysis, significant differences between CAL and GR were seen ($P=0.000$). Tooth position variables and gingival bleeding were not statistically significant for GR, however, a positive gingival bleeding and tooth malposition were associated with a higher frequency of GR (Fig. 3).

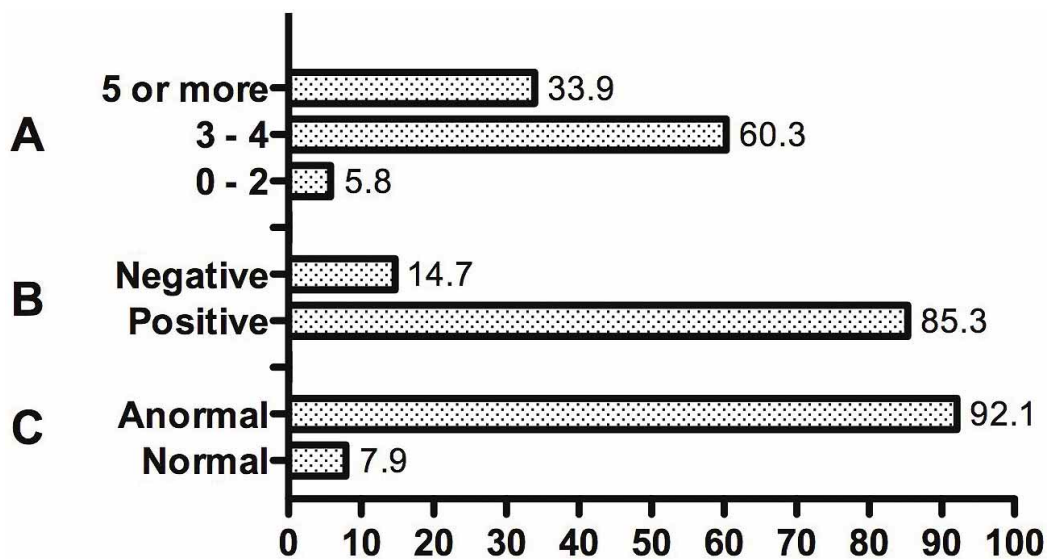


Fig. 3. Association of recession with clinical attachment level (A), gingival bleeding (B) and dental malposition (C).

DISCUSSION

Gingival recession can affect one tooth, a group of teeth, or be generalized throughout the mouth. Although it was suggested that the recession is a physiological process related to aging, no scientific evidence that check (Woofter, 1969; Tenenbaum, 1982), so it takes prospective cohort studies with longer follow-up periods, difficult to apply and expensive. These are just as scarce in the literature (Løe *et al.*, 1992; Matas *et al.*, 2011).

Currently, GR is considered a pathological consequence and/or repeated direct trauma on the gingiva (Kassab & Cohen, 2003; de la Rosa, 2011). While good oral hygiene is necessary to maintain the gingival health, aggressive brushing technique or brush hard type, may generate RG over time, associated with injuries such as abrasions, lacerations, keratoses and peeling mucous where the marginal gingiva mouth is the most affected (de la Rosa; Khocht *et al.*, 1993). In these cases, it is common to observe them in subjects with clinically healthy gingiva, little plaque and good oral hygiene (Rawal *et al.*, 2004).

In our study, mainly women between the age group 35-50 years showed the highest percentage of teeth affected by GR. This differs from that reported by de la Rosa in a representative population of the city of Monterrey, Mexico, where young patients under 30 years showed significantly less RG than groups between 30 and 40 years. Similarly, Matas *et al.*, reported in subjects between 18 and 34 years old a prevalence of 82.2% on a 10-year longitudinal study conducted on 40 Spanish dentists with an initial prevalence of 85% gingival recession (average 23.48 years), which did not change after 10 years (average 33.95 years). However, other authors (Løe *et al.*; Khocht *et al.*) have reported that recession increases with age and is higher in men than in women of the same age group.

GR was observed closely related to brushing, so the hypothesis that poor oral hygiene and favor abrasive brushing gingival recession has been widely studied as a causal factor or risk (Saxer). RG prevalence in South America, suggest similar results in Brazil, were between 83-89% (Susin *et al.*), Peru 73% (Maetahara) and Venezuela 83.3% (Segovia *et al.*). However, these studies have not necessarily been associated with variables such as hygiene technique, type of brush or brushing frequently used. Susin *et al.*,

significantly associated gingival recession presence of destructive periodontal disease and high levels of supragingival dental calculus and cigar smokers in 1460 subjects selected. In our case GR subjects were significantly associated with a higher frequency of brushing and insertion loss.

Recently, Chrysanthakopoulos *et al.*, reported a significant correlation between the prevalence of GR, brushing method and type of brush used by adult subjects in Greece. This contrasts with our results, where the correlation was significant in subjects who brushed once a day versus those two or more a day. It is relevant to note that the study subjects were patients of private dental practices, probably from a high socio-educational access, which was not reported. In Chile, few studies have reported the prevalence of GR. Wilckens *et al.*, report a high prevalence of GR in dental students at the University of Concepción, Chile, while Gamonal *et al.* (2010) presented results of CAL in adult Chilean population referred to the first Chilean National Dental Examination, which reported a 93.45% of young adults (35-44 years) with at least one site of insertion loss greater than 3 mm, of which 63 subjects were from Temuco, not reporting data related to the method and frequency of brushing or brush type used.

McCracken *et al.* (2009) conducted a single-blind randomized longitudinal study to compare the clinical effects of electric and manual toothbrushes in localized gingival recession sites incipient over 12 months, which analyzed the patterns and degree of wear of the toothbrush. No progression of recession with neither type of brush, and no significant differences in the pattern of wear of both types of brushes. In our study, we only report the use of manual toothbrush for over 10 years, recording the wear pattern of these same as being a cross-sectional and time tracking. Dorfer *et al.* (2009) recruited 109 periodontally healthy subjects with pre-existing GR, assigning 55 of them electric brush type and 54 of them either manual brush, match the frequency of brushing time and used toothpaste, followed for six months from the starting point, reducing both types of brush significantly pre-existing GR. The authors attribute this improvement in clinical levels to better implementation of the method of brushing.

We consider that our study subjects belonged to the regional main urban center, with access to different hygiene method and dental education in clinics

or University, and all patients had received at least once instruction regarding hygiene technique. In this regard Murray (1973) reported an incidence of up to 75% which increased with age in a population of 1000 patients who underwent military strict discipline of oral hygiene. However, Rajapakse *et al.* (2007) conducted a systematic review of the available evidence regarding the influence of brushing in the progression of non-inflammatory GR, concluding that the data that support or refute this association are inconclusive, similar to that reported by Matthews (2008). More longitudinal studies or prospective cohort appear to be necessary to resolve this paradigm.

Our results showed that of the 105 subjects studied, 530 teeth showed GR, and 188 teeth (35.47%) were class III Miller, more prevalent than class IV, most often in the first and second mandibular premolar, which

is different to that reported by other researchers in similar studies (de la Rosa; Chrysanthakopoulos).

Although Miller's classification of GR is most widely followed, this is not entirely exhaustive, and does not consider all cases of recession (Pini-Prato, 2011). To overcome this drawback, recently (Lehmann *et al.*, 2012) propose an evaluation method in vitro by 3D optical scanning and subsequent overlay for playback volume of GR, a highly reproducible method, with correlation coefficients between 0.997 and 0.999. This new method could allow reproducible volumetric evaluation of gingival recession, in which the operator controls the volumetric progression of periodontal soft tissues. For example following the procedures root coverage, and to detect early relapse which can be a promising approach to design new studies and improve the accuracy of results.

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RESUMEN: El objetivo fue estudiar la asociación entre la presencia de recesiones gingivales (RG) y características del cepillado manual en una población de adultos del sur de Chile. Se realizó un estudio estratificado probabilístico sobre una muestra aleatoria de 530 dientes afectados con RG en 105 pacientes (75 mujeres y 30 hombres), distribuidos en 3 grupos etáreos (18-34, 35-50 y 51-64 años), quienes utilizaron cepillado manual los últimos 10 años. Tres examinadores ($k=0,87$) evaluaron el tipo de cepillo, frecuencia y método de cepillado. Se registró la profundidad y ancho de las RG según la clasificación de Miller, profundidad de surco o bolsa, pérdida de inserción clínica, malposición dentaria y presencia o ausencia de hemorragia gingival al sondaje. Las RG fueron clase I en 28,68%, clase II en 35,47%, clase III en 29,24% y clase IV en el 6,61%. La mayor frecuencia se observó en el primer y segundo premolar mandibular. El método de cepillado combinado y el cepillo medio fueron los más utilizados. Se observaron diferencias significativas entre RG y frecuencia de cepillado ($p=0,001$); el 64,1% de dientes con RG se relacionaron a una frecuencia de cepillado de 3 o más veces al día. La pérdida de inserción clínica entre 3-4 mm se asoció a RG ($P=0,000$), afectando el 60,3% de los dientes. Además, la hemorragia gingival y mal posición dentaria se asociaron a una mayor frecuencia de RG. Una frecuencia de cepillado de 3 o más veces al día se asocia a la presencia de RG.

PALABRAS CLAVE: recesión gingival, tipo cepillo de dientes, técnica de cepillado, frecuencia del cepillado.

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