Received: 16 October 2022 | Revised: 18 May 2023 | Accepted: 23 June 2023

DOI: 10.1111/jcpe.13847

ORIGINAL ARTICLE

Journal of Clinical Periodontology WILEY

Epidemiology of mid-buccal gingival recessions according to the 2018 Classification System in South America: Results from two population-based studies

Franz Josef Strauss[1,2,3] | Crystal Marruganti[4] | Mario Romandini[5] | Franco Cavalla[2,3] | Patricio Neira[2,3] | Francisco J. Jiménez[6] | Ronald E. Jung[1] | Mariano Sanz[5,7] | Jorge Gamonal Aravena[2,3,8]

[1]Clinic of Reconstructive Dentistry, Center of Dental Medicine, University of Zurich, Zurich, Switzerland

[2]Department of Conservative Dentistry, Faculty of Dentistry, University of Chile, Santiago, Chile

[3]Center for Surveillance and Epidemiology of Oral Diseases, Aconcagua Clinical Research Unit, San Felipe, Chile

[4]Unit of Periodontology, Endodontology and Restorative Dentistry, Department of Medical Biotechnologies, University of Siena, Siena, Italy

[5]Department of Periodontology, Faculty of Dentistry, University of Oslo, Oslo, Norway

[6]Department of Surgical Sciences and Diagnosis, Faculty of Dentistry, University of Costa Rica, San José, Costa Rica

[7]ETEP (Etiology and Therapy of Periodontal and Peri-Implant Diseases) Research Group, University Complutense of Madrid, Madrid, Spain

[8]Center for Surveillance and Epidemiology of Oral Diseases, Faculty of Dentistry, University of Chile, Santiago, Chile

Correspondence

Jorge Gamonal Aravena, Facultad of Dentistry, University of Chile, Avenida Sergio Livingstone 943, Independencia, Santiago, Chile.
Email: jgamonal@odontologia.uchile.cl

Franz Josef Strauss, Clinic of Reconstructive Dentistry, Center of Dental Medicine, University of Zurich, Plattenstrasse 11, Zurich, Switzerland.
Email: franz.strauss@zzm.uzh.ch

Funding information

Fondo de Fomento al Desarrollo Científico y Tecnológico, Grant/Award Number: 2210101; Ibero-Panamerican Federation of Periodontology (FIPP); Colgate-Palmolive; Osteology Foundation, Grant/Award Number: 20-054

Abstract

Aim: The aim of this investigation was to estimate the prevalence, severity and extent of mid-buccal gingival recessions (GRs; classified according to the 2018 Classification System) and to identify their risk indicators in the South American population.

Materials and Methods: Epidemiological data from two cross-sectional studies—performed on 1070 South American adolescents and 1456 Chilean adults—were obtained. All participants received a full-mouth periodontal examination by calibrated examiners. GR prevalence was defined as the presence of at least one mid-buccal GR ≥ 1 mm. GRs were also categorized into different recession types (RTs) according to the 2018 World Workshop Classification System. Analyses for RT risk indicators were also performed. All analyses were carried out at the participant level.

Results: The prevalence of mid-buccal GRs was 14.1% in South American adolescents and 90.9% in Chilean adults. In South American adolescents, the prevalence of RTs was 4.3% for RT1 GRs, 10.7% for RT2 GRs and 1.7% for RT3 GRs. In Chilean adults, the prevalence of RT1 GRs was 0.3%, while the prevalence of RT2 and RT3 GRs was 85.8% and 77.4%, respectively. Full-Mouth Bleeding Score (FMBS; <25%) was associated with the presence of RT1 GRs in adolescents. The risk indicators for RT2/RT3 GRs mainly overlapped with those for periodontitis.

Jorge Gamonal Aravena and Franz Josef Strauss contributed equally to this study and should be considered as joint corresponding authors.

Conclusions: Mid-buccal GRs affected 14.1% of South American adolescents, whereas they affected most of the Chilean adult population (>90%). While RT1 GRs are more commonly observed in a non-representative cohort of South American adolescents (when compared to Chilean adults), the majority of Chilean adults exhibit RT2/RT3 GRs.

KEYWORDS
epidemiology, gingival recession, mucogingival deformities and conditions, periodontal diseases and conditions, risk factors

Clinical Relevance

Scientific rationale for study: There are a few nationally representative studies that have analysed the epidemiology of gingival recessions (GRs) according to the 2018 Classification System. However, the distribution of recession types (RTs) in South America has not yet been evaluated.
Principal findings: Mid-buccal GRs are prevalent in South America. While RT1 GRs are common in adolescents, most of the adults only present RT2/RT3 GRs.
Practical implications: Detailed knowledge of the prevalence and other demographic characteristics of GRs is essential for resource allocation in the oral health care system, as all major stakeholders should act upon their prevalence and contribute to their treatment and prevention.

1 | INTRODUCTION

Gingival recessions (GRs) are defined as the presence of an apical shift of the free gingival margin (FGM) with respect to the cemento-enamel junction (CEJ) (Cortellini & Bissada, 2018). Many factors, such as socio-demographic characteristics, mechanical trauma, tooth malposition, plaque-induced inflammation and periodontal phenotype, have been identified as risk indicators for GRs (Cortellini & Bissada, 2018; Romandini et al., 2020; Romano et al., 2022).

During the 2018 World Workshop, a new classification system—categorizing GRs with reference to interdental clinical attachment loss (CAL)—was introduced (Cortellini & Bissada, 2018; Jepsen et al., 2018). This classification encompasses three recession types (RTs; RT1, RT2 and RT3) based upon the different amounts of interproximal and mid-buccal CAL, as previously proposed by Cairo et al. (2011). Unlike the Miller classification (Miller, 1985), this new classification was designed to be a treatment-oriented system, capable of forecasting the potential for root coverage using the assessment of interproximal CAL (Cairo et al., 2011; Tonetti & Jepsen, 2014).

To date, only two studies—performed on representative samples of the U.S. and north-western Italian populations—have investigated the epidemiology of RTs according to the 2018 World Workshop Classification System (Romandini et al., 2020; Romano et al., 2022), yet no information is available regarding the distribution of RTs in South America. Indeed, given the strong influence of socio-economic, demographic and geographical factors on periodontal health and conditions (Eke et al., 2020), it is reasonable to hypothesize that also the epidemiology and risk indicators of RTs may change depending on the variety of those different factors. Thus, the aim of the current investigation was to estimate the prevalence, severity and extent of mid-buccal GRs (classified according to the 2018 Classification System) and to identify their risk indicators in the South American population.

2 | MATERIALS AND METHODS

2.1 | Study design

This analysis follows the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines (Vandenbroucke et al., 2007; von Elm et al., 2008) for reporting cross-sectional studies.

2.2 | Setting and participants

The present study reports the results from a secondary analysis of epidemiological data obtained from two previous cross-sectional studies gathering data from two study samples:

1. Sample of adolescents from South America: data were obtained between 2010 and 2012 from different countries in South America (i.e., Argentina, Chile, Colombia, Ecuador, and Uruguay). Participants were selected employing a three-stage sampling protocol, using schools as sampling units (Morales et al., 2015, 2021);
2. Representative sample of Chilean adults: data were obtained between 2007 and 2008 during the First Chilean National Examination Survey. Participants were recruited from 15 administrative regions and selected employing a stratified, multistage probability protocol (Gamonal et al., 2010; Strauss et al., 2019).

TABLE 1 Prevalence of mid-buccal gingival recessions (all types) at the participant level in South American adolescents and Chilean adults.

		Entire mouth										Only 15–25 (FDI)									
		GR ≥1 mm		GR ≥3 mm		GR ≥5 mm		GR ≥7 mm		Multiple GR ≥1 mm		GR ≥1 mm		GR ≥3 mm		GR ≥5 mm		GR ≥7 mm		Multiple GR ≥1 mm	
		N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
South American adolescents																					
Total		151	14.1	3	0.3	0	0.0	0	0.0	55	5.1	130	12.1	2	0.2	0	0.0	0	0.0	44	5.1
Gender	Male	64	12.4	2	0.4	0	0.0	0	0.0	22	4.3	53	10.3	2	0.4	0	0.0	0	0.0	16	3.1
	Female	87	15.7	1	0.2	0	0.0	0	0.0	33	5.9	77	13.9	0	0.0	0	0.0	0	0.0	28	5.0
Age group	12–15 years	33	9.7	0	0.0	0	0.0	0	0.0	11	3.2	30	8.8	0	0.0	0	0.0	0	0.0	10	2.9
	16–17 years	62	13.1	2	0.4	0	0.0	0	0.0	20	4.2	48	10.1	2	0.4	0	0.0	0	0.0	16	3.4
	≥18 years	56	21.9	1	0.4	0	0.0	0	0.0	24	9.4	52	20.3	0	0.0	0	0.0	0	0.0	18	7.0
Diabetes status	No	148	14.1	2	0.2	0	0.0	0	0.0	53	5.0	127	12.1	2	0.2	0	0.0	0	0.0	42	4.0
	Yes	3	15.8	1	5.3	0	0.0	0	0.0	2	10.5	3	15.8	0	0.0	0	0.0	0	0.0	2	10.5
Smoking status	No	85	10.9	3	0.4	0	0.0	0	0.0	34	4.4	74	9.5	2	0.3	0	0.0	0	0.0	28	3.6
	Current	66	22.8	0	0.0	0	0.0	0	0.0	21	7.2	56	19.3	0	0.0	0	0.0	0	0.0	16	5.5
Chilean adults																					
Total		1324	90.9	771	53.0	228	15.7	40	2.7	1070	73.5	1281	88.0	658	45.2	189	13.0	34	2.3	1022	70.2
Gender	Male	586	91.3	376	58.6	120	18.7	22	3.4	495	77.1	570	88.8	318	49.5	96	15.0	18	2.8	476	74.1
	Female	738	90.7	395	48.5	108	13.3	18	2.2	575	70.6	711	87.3	340	41.8	93	11.4	16	2.0	546	67.1
Age group	33–40 years	486	86.8	213	38.0	40	7.1	6	1.1	379	67.7	464	82.9	167	29.8	31	5.5	5	0.9	360	64.3
	41–64 years	499	92.6	278	51.6	60	11.1	9	1.7	410	76.1	482	89.4	227	42.1	40	7.4	6	1.1	385	71.4
	≥65 years	339	95.0	280	78.4	128	35.9	25	7.0	281	78.7	335	93.8	264	73.9	118	33.1	23	6.4	277	77.6
Education	≤12 years	1076	91.2	636	53.9	195	16.5	34	2.9	870	73.7	1046	88.6	554	46.9	163	13.8	29	2.5	835	70.8
	>12 years	248	89.9	135	48.9	33	12.0	6	2.2	200	72.5	235	85.1	104	37.7	26	9.4	5	1.8	187	67.8
Diabetes status	No	1184	91.3	698	53.8	202	15.6	39	3.0	961	74.1	1147	88.4	596	46.0	169	13.0	33	2.5	919	70.9
	Yes	140	88.1	73	45.9	26	16.4	1	0.6	109	68.6	134	84.3	62	39.0	20	12.6	1	0.6	103	64.8
Smoking status	No	571	90.6	332	52.7	98	15.6	18	2.9	463	73.5	556	88.3	285	45.2	83	13.2	17	2.7	444	70.5
	Former	284	91.9	165	53.4	44	14.2	5	1.6	232	75.1	276	89.3	140	45.3	36	11.7	4	1.3	216	69.9
	Current	469	90.7	274	53.0	86	16.6	17	3.3	375	72.5	449	86.8	233	45.1	70	13.5	13	2.5	362	70.0

Abbreviations: FDI, World Dental Federation; GR, gingival recession.

Further information about the datasets is reported in the Appendix S1. Both studies received ethical approval from the Committee of the Faculty of Medicine at the University of Chile (Chilean sample: ID18I10034; South American sample: ID2211010; Gamonal et al., 2010; Morales et al., 2015, 2021; Strauss et al., 2019), which is recognized by all other institutions. Informed consent was obtained from all participants, in accordance with the Declaration of Helsinki.

2.3 | Study variables

2.3.1 | Clinical examination

In both samples, GRs were measured during full-mouth clinical examination at six sites/teeth (excluding third molars) as the distance between the CEJ and the FGM. Other periodontal clinical parameters, such as probing pocket depth (PPD), CAL, plaque index (PI) and bleeding on probing (BOP), were recorded with a manual periodontal probe (UNC-15; Hu Friedy, Chicago, IL, USA). All examiners received theoretical information, clinical training and calibration prior to making the measurements. The clinical training was reiterated until an optimal consistency was achieved (κ values >0.80) (Landis & Koch, 1977). If a clear CEJ was not present, the reference point used was either the incisal edge or the occlusal edge. Further details about the examination are reported in the Appendix S1.

For the present investigation, only mid-buccal GRs were considered and, whenever present, they were categorized using the 2018 World Workshop Classification System (Cortellini & Bissada, 2018):

1. Recession Type 1 (RT1), when no loss of interproximal attachment was identified;
2. Recession Type 2 (RT2), when the loss of interproximal attachment was identified as less than or equal to the loss of buccal attachment (measured from the buccal CEJ to the apical portion of the buccal sulcus/pocket);
3. Recession Type 3 (RT3), when the amount of interproximal attachment exceeded the loss of buccal attachment.

In addition, the participants were categorized according to their periodontal status (healthy, Stage I, Stage II, Stage III, Stage IV) (Papapanou et al., 2018).

2.3.2 | Covariates

In both study samples, a personal interview, which encompassed socio-demographic, environmental and behavioural factors, was conducted before the clinical examination. The following covariates were used to define sub-populations in the two study samples and were considered as putative risk indicators for the presence of GRs: (i) sample of adolescents from South America: gender (male, female), age (12–15, 16–17, 18–20 years), Full-Mouth Plaque Score (FMPS;

TABLE 2 Prevalence of gingival recession types at the participant level in South American adolescents and Chilean adults.

	Entire mouth												Only 15–25 (FDI)											
	Total		GR ≥1 mm		GR ≥3 mm		GR ≥5 mm		GR ≥7 mm		Multiple GR ≥1 mm		Total		GR ≥1 mm		GR ≥3 mm		GR ≥5 mm		GR ≥7 mm		Multiple GR ≥1 mm	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
South American adolescents																								
RT1 GRs	46	4.3	46	100.0	1	2.2	0	0.0	0	0.0	11	23.9	38	3.4	38	100.0	0	0.0	0	0.0	0	0.0	8	21.1
RT2 GRs	114	10.7	114	100.0	2	1.8	0	0.0	0	0.0	50	43.9	94	8.8	94	100.0	2	2.1	0	0.0	0	0.0	38	40.4
RT3 GRs	18	1.7	18	100.0	1	5.6	0	0.0	0	0.0	12	66.7	11	1.0	11	100.0	0	0.0	0	0.0	0	0.0	6	54.5
Chilean adults																								
RT1 GRs	5	0.3	5	100.0	1	20.0	1	20.0	0	0.0	5	100.0	4	0.3	4	100.0	1	25.0	1	25.0	0	0.0	4	100.0
RT2 GRs	1249	85.8	1249	100.0	745	59.6	220	17.6	38	3.0	1042	83.4	1182	81.2	1182	100.0	630	53.3	178	15.1	32	2.7	981	83.0
RT3 GRs	1127	77.4	1127	100.0	707	62.7	212	18.8	32	2.8	986	87.5	1009	69.3	1009	100.0	568	56.3	168	16.7	26	2.6	884	87.6

Abbreviations: FDI, World Dental Federation; GR, gingival recession.

TABLE 3 Prevalence of gingival recession types at the tooth level in South American adolescents and Chilean adults.

	All types				RT1 GRs			RT2 GRs				RT3 GRs			
	GR ≥1 mm	GR ≥3 mm	GR ≥5 mm	GR ≥7 mm	GR ≥1 mm	GR ≥3 mm	GR ≥5 mm	GR ≥1 mm	GR ≥3 mm	GR ≥5 mm	GR ≥7 mm	GR ≥1 mm	GR ≥3 mm	GR ≥5 mm	GR ≥7 mm
South American adolescents															
Tooth type															
Total	1.4	0.01	-	-	0.2	0.0	-	1.1	0.01	-	-	0.09	-	-	-
Incisor	0.9	0.01	-	-	0.1	0.0	-	0.8	0.01	-	-	0.08	-	-	-
Canine	0.7	0.02	-	-	0.1	0.0	-	0.6	0.02	-	-	0.02	-	-	-
Premolar	2.5	0.0	-	-	0.4	0.0	-	1.9	0.0	-	-	0.07	-	-	-
Molar	1.1	0.01	-	-	0.1	0.01	-	0.8	0.0	-	-	0.1	-	-	-
Arch															
Maxillary	1.2	0.01	-	-	0.1	0.01	-	1.0	0.0	-	-	0.07	-	-	-
Mandibular	1.6	0.01	-	-	0.3	0.0	-	1.2	0.01	-	-	0.1	-	-	-
Side															
Right	1.5	0.01	-	-	0.3	0.01	-	1.2	0.01	-	-	0.09	-	-	-
Left	1.3	0.01	-	-	0.2	0.01	-	1.0	0.01	-	-	0.09	-	-	-
Chilean adults															
Tooth type															
Total	49.1	10.2	1.6	0.2	0.02	0.0	0.0	29.9	7.2	1.2	0.2	19.2	2.9	0.4	0.04
Incisor	40.5	6.7	1.1	0.1	0.01	0.01	0.01	22.3	4.3	0.7	0.06	18.1	2.4	0.4	0.04
Canine	44.2	8.9	1.8	0.3	0.04	0.0	0.0	28.2	6.9	1.4	0.2	16.0	2.1	0.4	0.06
Premolar	57.0	13.7	2.2	0.3	0.01	0.0	0.0	38.4	10.7	1.7	0.2	18.6	3.0	0.5	0.04
Molar	57.6	12.6	1.5	0.1	0.02	0.0	0.0	32.8	7.8	1.0	0.1	24.8	4.8	0.5	0.04
Arch															
Maxillary	45.9	7.9	1.1	0.1	0.01	0.0	0.0	26.2	5.4	0.8	0.1	19.7	2.6	0.3	0.02
Mandibular	51.9	12.1	2.1	0.3	0.03	0.01	0.01	33.1	8.8	1.5	0.2	18.7	3.3	0.6	0.06
Side															
Right	49.3	10.3	1.7	0.2	0.01	0.0	0.0	31.1	7.5	1.3	0.2	18.2	2.8	0.4	0.04
Left	48.9	10.1	1.5	0.2	0.02	0.01	0.01	28.7	6.9	1.0	0.1	20.2	3.2	0.5	0.05

Abbreviations: GR, gingival recession; RT, recession type.

<25%, 25%–50%, 50%–75%, >75%) and Full-Mouth Bleeding Score (FMBS; <25%, 25%–50%, 50%–75%, >75%); (ii) representative sample of Chilean adults: gender (male, female), age (33–40, 41–64, ≥65 years), years of education (≤12, >12 years), diabetes status (self-reported; 'Have you ever been diagnosed with diabetes?': no, yes), smoking status (self-reported; 'Have you ever smoked?': no, former smoker, smoker. If yes, 'How many cigarettes do you smoke on average per day?'), FMPS (<25%, 25%–50%, 50%–75%, >75%) and FMBS (<25%, 25%–50%, 50%–75%, >75%).

2.4 | Study size

For the sample of South American adolescents, the study size was arrived at by considering the rate of 4.5% of CAL ≥3 mm in one or more sites with 1.6% range of error, which would result in a required sample of 1032 subjects; after oversampling to allow for better precision in the estimate, a total of 1070 adolescents aged 12–20 years was reached. For the representative sample of Chilean adults, the study size was arrived at by estimating an 80% prevalence of periodontitis in Chile. To achieve 95% precision rate with an error 0.02%, 1561 adults were required to be examined.

2.5 | Statistical methods

The statistical plan employed in this study differed from the one previously reported (Morales et al., 2015). The prevalence of mid-buccal GRs was defined as the presence of at least one mid-buccal GR ≥ 1 mm, and it was reported according to severity cut-offs: ≥1 mm, ≥3 mm, ≥5 mm and ≥7 mm. Moreover, the prevalence of RT according to the 2018 World Workshop Classification System (Cortellini & Bissada, 2018) as well as the prevalence of multiple GRs—defined as the presence of mid-buccal GRs in at least two adjacent teeth—were also reported. The prevalence of GRs was computed both at the participant level and tooth level. The extent of mid-buccal GRs was defined as the percentage of teeth affected by GR (≥1 mm) in subjects with GR and was categorized as localized (<15% of teeth) and generalized (≥15% of teeth). Binary logistic regression models were built to identify the risk indicators (among the tested covariates for each sample) for the presence of GRs. The presence of GRs was

TABLE 4 Extent of mid-buccal gingival recessions (GRs) at the participant level in South American adolescents and Chilean adults.

		GR extent			
		Localized (≤15%)		Generalized (>15%)	
		N	%	N	%
South American adolescents					
Total		123	81.5	28	18.5
Gender	Male	53	82.8	11	17.2
	Female	70	80.5	17	19.5
Age group	12–15 years	28	84.8	5	15.2
	16–17 years	53	85.5	9	14.5
	≥18 years	42	75.0	14	25.0
Diabetes status	No	121	81.8	27	18.2
	Yes	2	66.7	1	33.3
Smoking status	No	70	82.4	15	17.6
	Yes	53	80.3	13	19.7
Chilean adults					
Total		170	12.8	1154	87.2
Gender	Male	58	9.9	528	90.1
	Female	112	15.2	626	84.8
Age group	33–40 years	95	19.5	391	80.5
	41–64 years	60	12.0	439	88.0
	≥65 years	15	4.4	324	95.6
Education	≤12 years	127	11.8	949	88.2
	>12 years	43	17.3	205	82.7
Diabetes status	No	148	12.5	1036	87.5
	Yes	22	15.7	118	84.3
Smoking status	No	72	21.6	499	87.4
	Former	37	13.0	247	87.0
	Current	61	13.0	408	87.0

considered for each study sample as follows: (i) sample of adolescents from South America: presence of GR ≥ 1 mm (vs. no GR), presence of RT1 (vs. no RT1), presence of RT2 (vs. no RT2) and presence of RT3 (vs. no RT3); (ii) representative sample of Chilean adults: presence of GR ≥ 1 mm (vs. no GR), presence of RT2 (vs. no RT2) and presence of RT3 (vs. no RT3), exclusive presence of RT3 (vs. exclusive presence of RT2). Afterwards, multiple logistic regression models were built to adjust the crude estimates for the covariates that resulted in statistical significance in the simple models ($p < .10$). Stratified analyses according to position of GRs (anterior, posterior, mandibular and maxillary) were also performed. Odds ratios (ORs) with 95% confidence intervals (95% CIs) were reported together with two-tailed p-values derived from Wald's Chi-squared test. The prevalence of GR by RT and tooth type in the maxilla/mandible was graphed for both cohorts. All statistical analyses were performed at the participant level, using a specific statistical software (IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp), and setting the level of significance at $\alpha = .05$.

3 | RESULTS

3.1 | Sample of adolescents from South America

The sampling strategy led to the selection of 1070 South American adolescents, the majority of whom were females (51.9%) and attended a public school (52.2%). In addition, 27.1% were identified as smokers (mean number of cigarettes/day = 4.2 ± 5.0) and 1.8% of them as having diabetes.

3.1.1 | Prevalence and extent of mid-buccal GRs

At the participant level, the prevalence of mid-buccal GRs (all types) was 14.1% in the entire mouth and 12.1% when considering only the aesthetic zone (Table 1). The mean number of GRs per patient was 0.4 ± 1.3 (1.4% of the teeth affected). The prevalence of RT1 GRs was 4.3%, and it slightly decreased to 3.4% in the aesthetic zone. All RT1 GRs were 1–3 mm. RT2 GRs and RT3 GRs affected around 10.7% and 1.7% of the adolescent population, respectively (Tables 2 and S1). At the participant level, the prevalence of multiple GRs was 5.1% in the entire mouth, with consistent values when considering only the anterior (5.1%), maxillary (4.3%) and mandibular (3.7%) areas but not the posterior area (0.6%) (Tables 1 and S2–S4). At the tooth level, the highest prevalence of GRs was recorded for premolars (2.5%), in the mandibular arch (1.6%) and on the right-hand side (1.5%) (Table 3). In addition, 18.5% of adolescents had generalized GRs (Table 4). The prevalence of GR by RT and tooth type in maxilla/mandible is shown in Figure 1.

3.1.2 | Risk indicators for GRs

In South American adolescents, age group, smoking status, FMPS and FMBS were associated with the presence of GR ≥1 mm. While GRs (≥1 mm) were more frequent in subjects aged ≥18 years (vs. 12–15 years: OR = 2.2; 95% CI: 1.3–3.4), smokers (vs. non-smokers: OR = 2.2; 95% CI: 1.5–3.3), and FMBS equalled 25%–50% or 50%–75% (vs. FMBS < 25%: OR = 2.4; 95% CI: 1.5–3.9, and OR = 2.0; 95% CI: 1.0–4.1), they were significantly less frequent whenever FMPS equalled 25%–50% (vs. FMPS < 25%: OR = 0.06; 95% CI: 0.3–0.9) (Table 5). With regard to RTs, the higher the FMPS and FMBS values, the lower the odds of having RT1 and the higher the odds of having RT2; in the multivariable models, the estimates remained significant for FMBS but not for FMPS, although a trend in this direction could be noted ($p > .05$). In addition, a higher age (≥18 years) showed a non-significant tendency towards increased odds of having any RT (RT1, RT2 and RT3) in both simple and multiple regression models (Tables S6–S9).

3.2 | Representative sample of Chilean adults

The sampling strategy led to the selection of 1561 Chilean adults. From this sample, 105 edentulous subjects were excluded; therefore, 1456 participants were included in this study. Most participants were females (55.9%) and had ≤12 years of education (80.9.%). In addition, 35.5% of them were identified as smokers (mean number of cigarettes/day = 6.8 ± 7.7) and 21.2% as former smokers (mean number of cigarettes/day = 3.9 ± 7.2); moreover, 10.9% of them had diabetes.

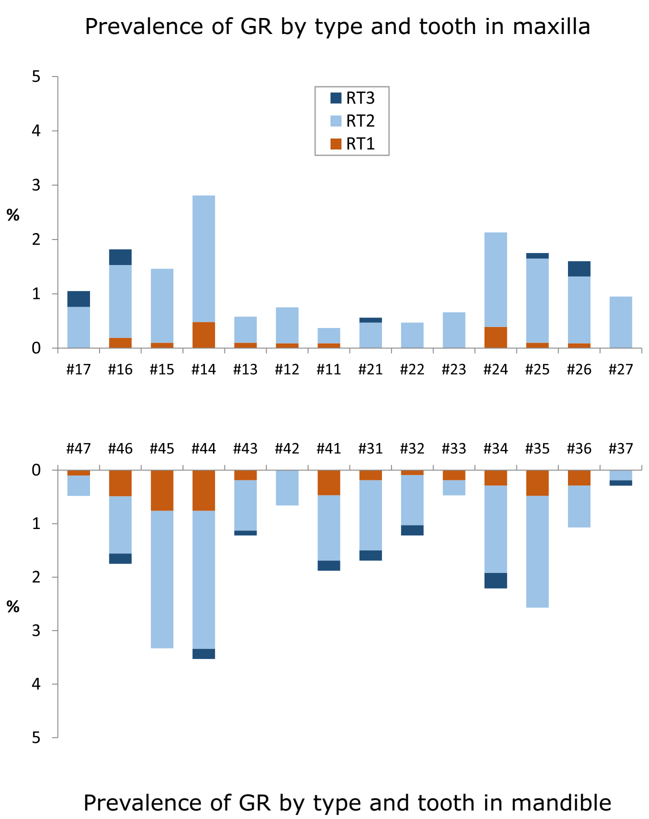

FIGURE 1 Prevalence of gingival recessions (GRs) by recession type (RT) and tooth type in maxilla and mandible of South American adolescents.

TABLE 5 Simple and multiple regression models for the risk indicators for mid-buccal gingival recessions (all types) in South American adolescents and Chilean adults.

		GR ≥1 mm			
		Crude OR (95% CI)	*p*-Value	Adjusted OR (95% CI)	*p*-Value
South American adolescents ($N = 1070$)					
Gender	Female	1		1	
	Male	0.8 (0.5–1.1)	.128	-	-
Age group	12–15 years	1		1	
	16–17 years	1.4 (0.9–2.2)	.134	1.4 (0.9–2.2)	.200
	≥ 18 years	2.6 (1.6–4.2)	**<.001*****	2.2 (1.3–3.4)	**.002*****
Diabetes status	No	1		1	
	Yes	1.1 (0.3–3.9)	.832	-	-
Smoking status	No	1		1	
	Yes	2.4 (1.7–3.4)	**<.001*****	2.2 (1.5–3.3)	**<.001*****
FMPS	<25%	1		1	
	25%–50%	0.7 (0.4–1.1)	.139	0.6 (0.3–0.9)	**.039***
	50%–75%	1.2 (0.7–1.9)	.496	0.9 (0.5–1.5)	.612
	≥75%	1.9 (1.2–2.9)	**<.001*****	1.4 (0.8–2.5)	.270
FMBS	<25%	1		1	
	25%–50%	2.8 (1.9–4.2)	**<.001*****	2.4 (1.5–3.9)	**<.001*****
	50%–75%	2.7 (1.5–4.9)	**.001****	2.0 (1.0–4.1)	**.044***
	≥75%	1.1 (0.5–2.6)	.752	0.9 (0.4–2.2)	.785
Chilean adults ($N = 1456$)					
Gender	Female	1		1	
	Male	1.1 (0.8–1.6)	.685	-	-
Age group	33–40 years	1		1	
	41–64 years	1.9 (1.3–2.9)	**<0.001*****	2.1 (1.4–3.3)	**<.001*****
	≥65 years	2.9 (1.7–4.9)	**<0.001*****	3.5 (1.9–6.1)	**<.001*****
Education	≤12 years	1		1	
	>12 years	0.9 (0.6–1.3)	0.488	-	-
Diabetes status	No	1		1	
	Yes	0.7 (0.4–1.2)	0.182	-	-
Smoking status	No	1		1	
	Former	1.2 (0.7–1.9)	0.521	-	-
	Current	1.0 (0.7–1.5)	0.963	-	-
FMPS	<25%	1		1	
	25%–50%	1.9 (1.2–3.1)	**.007****	0.7 (0.4–1.3)	.218
	50%–75%	2.2 (1.4–3.7)	**.002****	0.7 (0.4–1.3)	.269
	≥75%	2.5 (1.5–4.3)	**.001****	0.6 (0.3–1.3)	.221
FMBS	<25%	1		1	
	25%–50%	2.4 (1.3–4.4)	.006**	3.1 (1.6–6.1)	**.001****
	50%–75%	5.4 (2.8–10.4)	**<.001*****	8.9 (4.1–19.5)	**<.001*****
	≥75%	7.4 (4.8–11.4)	**<.001*****	10.9 (5.9–20.2)	**<.001*****

Note: Significant *p*-values are shown in bold.
Abbreviations: FMBS, Full-Mouth Bleeding Score; FMPS, Full-Mouth Plaque Score; GR, gingival recession.
*$p < .05$; **$p < .01$; ***$p < .001$.

3.2.1 | Prevalence and extent of mid-buccal GRs

At the participant level, the prevalence of mid-buccal GRs (all types) was 90.9% in the entire mouth, and it slightly decreased to 88.0% when considering only the aesthetic zone (Table 1). The mean number of GRs per patient was 9.4 ± 7.2 (48.9% of the teeth affected). The prevalence of RT1 GRs was 0.3%, with most of the cases being 1–2 mm. RT2 GRs and RT3 GRs affected around 85.8% and 77.4% of the adult population, respectively (Tables 2 and S1). The prevalence of multiple GRs was 73.5% in the entire mouth, with consistent values

FIGURE 2 Prevalence of gingival recessions (GRs) by recession type (RT) and tooth type in maxilla and mandible of Chilean adults.

when considering only the anterior (70.2%) and the mandibular (67.3%) areas, but with slightly decreased values when considering only the posterior (31.3%) and maxillary (27.9%) areas (Tables 1 and S2–S4). At the tooth level, the highest prevalence of GRs was recorded for premolars (57%), in the mandibular arch (51.9%) and on the right-hand side (49.3%) (Table 3). In addition, 87.2% of adults had generalized GRs (Table 4). The prevalence of GR by RT and tooth type in maxilla/mandible is shown in Figure 2.

3.2.2 | Risk indicators for GRs

In Chilean adults, age and FMPS were associated with the presence of GR ≥1 mm. Indeed, GRs (≥1 mm) were significantly more frequent in the higher age groups (41–64 and ≥65 years vs. 33–40 years, respectively) and for higher FMBS values (25%–50%, 50%–75% and ≥75% vs. <25%, respectively) (Table 5). With regard to RTs, subjects with a more advanced age (≥65 years) had significantly lower odds of RT2 GRs (OR = 0.5; 95% CI: 0.3–0.9), while they had around 3 times increased odds of having RT3 GRs (either exclusively or not) when compared to younger subjects (OR = 1.9; 95% CI: 1.3–3.0; RT3 exclusively: OR = 3.1; 95% CI: 1.4–6.6). The prevalence of GRs increased with the increased severity of periodontitis (Tables S5–S8). In addition, while the odds of RT3 GRs increased with increasing FMPS and FMBS values, the odds of RT2 GRs increased with higher FMBS but lower FMPS values (Tables S7–S9). Increasing age and FMPS were associated with increasing odds of the exclusive presence of RT3 GRs (Table S10).

4 | DISCUSSION

4.1 | Main findings

This study aimed to investigate the prevalence of GRs in Chilean adults and South American adolescents. Results showed that mid-buccal GRs were prevalent in over 90% of Chilean adults, while in South American adolescents it was 14.1%. The distribution of the categories of RTs was more or less equal among adolescents (ranging from 1.7% to 4.3%). However, in the adult population there was a high prevalence of RT2/RT3 GRs (77%–85%), while the prevalence of RT1 GRs was only 0.3%. As expected, the prevalence of RT2/RT3 increased with the severity of periodontitis. Differences in prevalence between the two cohorts could be attributed to a higher age, along with a higher prevalence of diabetes and smokers among adults.

In adolescents, the prevalence of RT1 GRs decreased with increasing FMPS and FMBS values, which may be attributed to the higher prevalence of periodontitis in individuals with extended plaque accumulation and gingival inflammation (Kinane et al., 2017). In contrast, the risk factors for RT3 GRs, and partly for RT2 GRs, overlapped with the risk factors for periodontitis in both adolescent and adult populations. This finding aligns with previous studies (Romandini et al., 2020; Romano et al., 2022) and is expected because RT2/RT3 GRs are identified through interproximal attachment loss. In the current analysis, the prevalence of GRs increased with the severity of periodontitis stage.

The findings of this study are consistent with previous population-based studies on the prevalence of mid-buccal GRs in South America (Rios et al., 2014; Serrano et al., 2018; Susin et al., 2004). Susin et al. (2004) reported a higher prevalence of GRs (≥1 mm) in Brazilian subjects aged 14–19 years (29.5%) compared to that observed in South American adolescents (14.1%) in this study. The divergent results may be attributed to differences in socio-economic status of the participants and variations in sampling strategies between the two studies, with one using a representative sample while the other using a non-representative sample.

Similar to Susin et al. (2004), a representative survey conducted in Porto Alegre (Brazil) on adults (≥35 years old) found slightly higher but comparable prevalence rates of GRs (99.7% vs. 90.9%, respectively) (Rios et al., 2014). The observed differences may be due to variations in age range, sampling methods and socio-economic characteristics of the study participants. The Fourth Colombian Oral Health Study reported an overall prevalence of buccal GRs of 69.7% (Serrano et al., 2018). Although Serrano et al. (2018) did not distinguish between mid-buccal and other buccal sites, their results may be comparable to the mid-buccal estimates for GRs (≥1 mm) in this investigation.

In previous epidemiological studies, the prevalence of RTs has been reported in different populations based on the 2018 World Workshop Classification System (Romandini et al., 2020; Romano et al., 2022). In this investigation, the prevalence of RT1 GRs was only

0.3%, which is much lower than in representative samples from the U.S. (12.4%) and north-western Italian populations (40.9%). Conversely, the prevalence of RT3 GRs was much higher in this study (77.4%) than in the other two studies (54.9% and 36.7%). The observed differences could be attributed to the higher prevalence of periodontitis in South America compared to North America and Europe, as well as the lower socio-economic status of the investigated cohorts, indicated by their lower level of education than in previous studies (Bernabe et al., 2020).

In this investigation, the prevalence of RT1 GRs was higher (4.3%) and the prevalence of RT3 GRs was lower (1.7%) in South American adolescents than in the adult sample (0.3% and 77.4%, respectively), which may be due to the lower prevalence of periodontitis in younger individuals (Eke et al., 2012). However, the prevalence of RT2/RT3 GRs in the younger cohort was still high, at 10.7% and 1.7%, respectively. This suggests a relatively high prevalence of periodontitis, as also shown in a previous study of the same cohort (Morales et al., 2021). The higher prevalence of periodontitis in South America, combined with poorer oral hygiene practices and different socio-economic conditions, including healthcare access, education and lifestyle factors, may have contributed to these findings (Peres et al., 2019). Unfortunately, these factors were not measured in the current investigation. It is important to consider all of these determinants of health when interpreting the prevalence of interdental CAL loss in both cohorts.

The risk indicators for mid-buccal RT3 GRs, and partially those for RT2 GRs, are similar to those for periodontitis, such as older age and higher FMPS and FMBS values (Genco & Borgnakke, 2013), as reported by previous population-based studies (Romandini et al., 2020; Romano et al., 2022). Specifically, FMPS and FMBS, which are surrogate measures of periodontitis and interproximal attachment loss, were directly associated with RT3 GRs and partly with RT2 GRs. An older age was also a significant contributor to mid-buccal RT3 GRs, reflecting the cumulative loss of periodontal attachment with aging (Baima et al., 2021; Teles et al., 2018). Additionally, higher FMPS values and older age were associated with an increased likelihood of the exclusive presence of RT3 GRs, as interdental CAL loss is a diagnostic criterion for identifying periodontitis (Papapanou et al., 2018). Conversely, the risk indicators for RT1 GRs are opposite to those for periodontitis, with FMPS inversely associated with RT1 GRs.

4.2 | Limitations and strengths

This study represents the first investigation of mid-buccal RT prevalence and risk factors in the South American population. The inclusion of a representative sample of Chilean adults with full-mouth periodontal examination provided a valid representation of mid-buccal RT1 GR epidemiology. However, the findings may not be generalizable due to the inclusion of a non-representative sample of South American adolescents; moreover, in this cohort, the presence of a selection bias related to the inclusion of only high school adolescents—who are more likely to belong to a higher socio-economic status—cannot be excluded. Additionally, the lack of calibration data for RT definition and missing information on GR depth when the CEJ was absent may reduce measurement reproducibility. Adjusted models had high residual confounding due to the absence of key risk factor variables (e.g., periodontal phenotype, tooth malposition, domiciliary oral hygiene practices). Lastly, the cross-sectional design cannot determine the temporal relationship between the risk factors and GR occurrence.

5 | CONCLUSION

The prevalence of GRs is high in the South American population, with RT1 GRs being more prevalent in a non-representative cohort of adolescents and decreasing in adults due to the higher prevalence of periodontitis in the latter group. Low FMPS and FMBS were identified as risk factors for RT1 GRs in adolescents, while the risk indicators for RT2/RT3 GRs overlapped with those for periodontitis in both adolescents and adults. Further research is needed to confirm the generalizability of these findings to other populations, and to determine the causal relationship between the identified risk factors and the onset/progression of mid-buccal RT1 GRs.

AUTHOR CONTRIBUTIONS

All authors made substantial contributions to this study. Franz Josef Strauss, Mario Romandini and Jorge Gamonal contributed to the conception and design of the study. Franz Josef Strauss, Crystal Marruganti, Mario Romandini, Franco Cavalla, Patricio Neira and Francisco J. Jiménez contributed to the clinical phases of the study and collected the data. Franz Josef Strauss, Crystal Marruganti, Mario Romandini, Ronald Jung, Mariano Sanz, Jorge Gamonal Aravena contributed to the interpretation of the data and drafted and finalized the manuscript. All authors critically reviewed and approved the final manuscript.

ACKNOWLEDGEMENTS

We thank the Universities and educational institutions for their support of this study. This research was supported by The Scientific and Technological Development Support Fund (FONDEF, Santiago de Chile, Chile), Chile project; ID18I10034, the Ibero-Panamerican Federation of Periodontology (FIPP) and Colgate-Palmolive (New York, NY, USA). Franz Strauss is further supported by a grant (20-054) from the Osteology Foundation, Switzerland. The funding bodies were not otherwise involved in the design of the study, or in the collection, analysis or interpretation of data and writing of the manuscript. Open access funding provided by Universitat Zurich.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Franz Josef Strauss https://orcid.org/0000-0002-5832-7327
Crystal Marruganti https://orcid.org/0000-0003-1088-2046
Mario Romandini https://orcid.org/0000-0001-5646-083X
Franco Cavalla https://orcid.org/0000-0002-6896-5744
Ronald E. Jung https://orcid.org/0000-0003-2055-1320
Jorge Gamonal Aravena https://orcid.org/0000-0001-7703-6587

REFERENCES

Baima, G., Romandini, M., Citterio, F., Romano, F., & Aimetti, M. (2021). Periodontitis and accelerated biological aging: A Geroscience approach. *Journal of Dental Research*, *101*, 125–132. https://doi.org/10.1177/00220345211037977

Bernabe, E., Marcenes, W., Hernandez, C. R., Bailey, J., Abreu, L. G., Alipour, V., Amini, S., Arabloo, J., Arefi, Z., Arora, A., Ayanore, M. A., Bärnighausen, T. W., Bijani, A., Cho, D. Y., Chu, D. T., Crowe, C. S., Demoz, G. T., Demsie, D. G., Dibaji Forooshani, Z. S., … Kassebaum, N. J. (2020). Global, regional, and national levels and trends in burden of oral conditions from 1990 to 2017: A systematic analysis for the global burden of disease 2017 study. *Journal of Dental Research*, *99*(4), 362–373. https://doi.org/10.1177/0022034520908533

Cairo, F., Nieri, M., Cincinelli, S., Mervelt, J., & Pagliaro, U. (2011). The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: An explorative and reliability study. *Journal of Clinical Periodontology*, *38*(7), 661–666. https://doi.org/10.1111/j.1600-051X.2011.01732.x

Cortellini, P., & Bissada, N. F. (2018). Mucogingival conditions in the natural dentition: Narrative review, case definitions, and diagnostic considerations. *Journal of Periodontology*, *89*, S204–S213. https://doi.org/10.1002/JPER.16-0671

Eke, P. I., Borgnakke, W. S., & Genco, R. J. (2020). Recent epidemiologic trends in periodontitis in the USA. *Periodontology 2000*, *82*(1), 257–267. https://doi.org/10.1111/prd.12323

Eke, P. I., Page, R. C., Wei, L., Thornton-Evans, G., & Genco, R. J. (2012). Update of the case definitions for population-based surveillance of periodontitis. *Journal of Periodontology*, *83*(12), 1449–1454. https://doi.org/10.1902/jop.2012.110664

Gamonal, J., Mendoza, C., Espinoza, I., Muñoz, A., Urzúa, I., Aranda, W., Carvajal, P., & Arteaga, O. (2010). Clinical attachment loss in Chilean adult population: First Chilean National Dental Examination Survey. *Journal of Periodontology*, *81*(10), 1403–1410. https://doi.org/10.1902/jop.2010.100148

Genco, R. J., & Borgnakke, W. S. (2013). Risk factors for periodontal disease. *Periodontology 2000*, *62*(1), 59–94. https://doi.org/10.1111/j.1600-0757.2012.00457.x

Jepsen, S., Caton, J. G., Albandar, J. M., Bissada, N. F., Bouchard, P., Cortellini, P., Demirel, K., de Sanctis, M., Ercoli, C., Fan, J., Geurs, N. C., Hughes, F. J., Jin, L., Kantarci, A., Lalla, E., Madianos, P. N., Matthews, D., McGuire, M. K., Mills, M. P., … Yamazaki, K. (2018). Periodontal manifestations of systemic diseases and developmental and acquired conditions: Consensus report of workgroup 3 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *Journal of Clinical Periodontology*, *45*(December 2017), S219–S229. https://doi.org/10.1111/jcpe.12951

Kinane, D. F., Stathopoulou, P. G., & Papapanou, P. N. (2017). Periodontal diseases. *Nature Reviews Disease Primers*, *3*, 17038. https://doi.org/10.1038/nrdp.2017.38

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159–174. https://doi.org/10.2307/2529310

Miller, P. D. (1985). A classification of marginal tissue recession. *The International Journal of Periodontics & Restorative Dentistry*, *5*(2), 8–13 http://europepmc.org/abstract/MED/3858267

Morales, A., Carvajal, P., Romanelli, H., Gómez, M., Loha, C., Esper, M. E., Musso, G., Ardila, C. M., Duque, A., Medina, M., Bueno, L., Andrade, E., Mendoza, C., & Gamonal, J. (2015). Prevalence and predictors for clinical attachment loss in adolescents in Latin America: Cross-sectional study. *Journal of Clinical Periodontology*, *42*(10), 900–907. https://doi.org/10.1111/jcpe.12452

Morales, A., Strauss, F. J., Hämmerle, C. H. F., Romandini, M., Cavalla, F., Baeza, M., Sanz, M., & Gamonal, J. (2021). Performance of the 2017 AAP/EFP case definition compared with the CDC/AAP definition in population-based studies. *Journal of Periodontology*, *93*, 1003–1013. https://doi.org/10.1002/JPER.21-0276

Papapanou, P. N., Sanz, M., Buduneli, N., Dietrich, T., Feres, M., Fine, D. H., Flemmig, T. F., Garcia, R., Giannobile, W. V., Graziani, F., Greenwell, H., Herrera, D., Kao, R. T., Kebschull, M., Kinane, D. F., Kirkwood, K. L., Kocher, T., Kornman, K. S., Kumar, P. S., … Tonetti, M. S. (2018). Periodontitis: Consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *Journal of Clinical Periodontology*, *45*(March), S162–S170. https://doi.org/10.1111/jcpe.12946

Peres, M. A., Macpherson, L. M. D., Weyant, R. J., Daly, B., Venturelli, R., Mathur, M. R., Listl, S., Celeste, R. K., Guarnizo-Herreño, C. C., Kearns, C., Benzian, H., Allison, P., & Watt, R. G. (2019). Oral diseases: A global public health challenge. *Lancet*, *394*(10194), 249–260. https://doi.org/10.1016/S0140-6736(19)31146-8

Rios, F. S., Costa, R. S. A., Moura, M. S., Jardim, J. J., Maltz, M., & Haas, A. N. (2014). Estimates and multivariable risk assessment of gingival recession in the population of adults from Porto Alegre, Brazil. *Journal of Clinical Periodontology*, *41*(11), 1098–1107. https://doi.org/10.1111/jcpe.12303

Romandini, M., Soldini, M. C., Montero, E., & Sanz, M. (2020). Epidemiology of mid-buccal gingival recessions in NHANES according to the 2018 World Workshop Classification System. *Journal of Clinical Periodontology*, *47*(10), 1180–1190. https://doi.org/10.1111/jcpe.13353

Romano, F., Perotto, S., Baima, G., Macrì, G., Picollo, F., Romandini, M., Mariani, G. M., & Aimetti, M. (2022). Estimates and multivariable risk assessment of mid-buccal gingival recessions in an Italian adult population according to the 2018 World Workshop Classification System. *Clinical Oral Investigations.*, *26*, 4769–4780. https://doi.org/10.1007/s00784-022-04441-w

Serrano, C., Suàrez, E., & Uzaheta, A. (2018). Prevalence and extent of gingival recession in a national sample of Colombian adults. *Journal of the International Academy of Periodontology*, *3*(20), 94–101.

Strauss, F. J., Espinoza, I., Stähli, A., Baeza, M., Cortés, R., Morales, A., & Gamonal, J. (2019). Dental caries is associated with severe periodontitis in Chilean adults: A cross-sectional study. *BMC Oral Health*, *19*(1), 278. https://doi.org/10.1186/s12903-019-0975-2

Susin, C., Haas, A. N., Oppermann, R. V., Haugejorden, O., & Albandar, J. M. (2004). Gingival recession: Epidemiology and risk indicators in a representative urban Brazilian population. *Journal of Periodontology*, *75*, 1377–1386.

Teles, R., Moss, K., Preisser, J. S., Genco, R., Giannobile, W., Corby, P., Garcia, N., Jared, H., Torresyap, G., Salazar, E., Moya, J., Howard, C., Schifferle, R., Falkner, K. L., Gillespie, J., Dixon, D., & Cugini, M. A. (2018). Patterns of periodontal disease progression based on linear mixed models of clinical attachment loss. *Journal of Clinical Periodontology*, *45*(1), 15–25. https://doi.org/10.1111/jcpe.12827

Tonetti, M. S., & Jepsen, S. (2014). Clinical efficacy of periodontal plastic surgery procedures: Consensus Report of Group 2 of the 10th European Workshop on Periodontology. *Journal of Clinical Periodontology*, *41*, S36–S43. https://doi.org/10.1111/jcpe.12219

Vandenbroucke, J. P., von Elm, E., Altman, D. G., Gøtzsche, P. C., Mulrow, C. D., Pocock, S. J., Poole, C., Schlesselman, J. J., & Egger, M. (2007). Strengthening the reporting of observational studies in epidemiology (STROBE): Explanation and elaboration. *Annals of Internal Medicine*, *147*(8), W163–W194. https://doi.org/10.7326/0003-4819-147-8-200710160-00010-w1 von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2008). The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Journal of Clinical Epidemiology*, *61*(4), 344–349. https://doi.org/10.1016/j.jclinepi.2007.11.008

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Strauss, F. J., Marruganti, C., Romandini, M., Cavalla, F., Neira, P., Jiménez, F. J., Jung, R. E., Sanz, M., & Gamonal Aravena, J. (2023). Epidemiology of mid-buccal gingival recessions according to the 2018 Classification System in South America: Results from two population-based studies. *Journal of Clinical Periodontology*, *50*(10), 1336–1347. https://doi.org/10.1111/jcpe.13847