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Prevalence and risk indicators of buccal gingival recessions in a Moroccan periodontitis patients: A retrospective study

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ABSTRACT

Background: This study investigates the prevalence, distribution and risk indicators of buccal gingival recessions (GRs) in periodontitis patients.
Methods: A retrospective examination of 400 periodontitis patients files was performed using an operating sheet. Univariate logistic regression analysis was performed to identify risk indicators of GRs. Multivariate regression analysis was conducted for selected variables with $p < 0.05$.
Results: 354/400 (88.5 %) patients have at least one GR $\geq$ 1 mm. The prevalence of recession type (RT) at the patient level was 0.5 %, 2.25 % and 85.75 % for RT1, RT2 and RT3 respectively. Lower incisors are the most affected teeth (79.8 %). Upper canines present the lowest frequency (41.8 %). The univariate logistic regression showed that age (SE = 0.021; 95 % CI 1.01–1.10; p = 0.006), plaque index (SE = 0.50; 95 % CI 1.49–10.50; p = 0.006), level of plaque control (SE = 0.529; 95 % CI 0.90–0.72; p = 0.010) and periodontitis stage (SE = 0.41; 95 % CI 1.41–7.07; p = 0.005) were significantly associated with the presence of GR. In the multivariate regression model, significant results were confirmed only for age (SE = 0.021; 95 % CI 1.02–1.17; p = 0.006) and periodontitis stage (SE = 0.41; 95 % CI 1.35–6.75; p = 0.007).
Conclusion: The cross-sectional study showed a high prevalence of GRs. Lower incisors were the most affected teeth. Most patients have GRs with advanced interproximal attachment loss (RT3 GRs). Age, plaque index, level of plaque control and periodontitis stage resulted as risk indicators of GRs.

1. Introduction

Gingival recession (GR) is a buccal exposure of the root surface due to the apical migration of the gingival margin associated with clinical attachment loss (Cortellini & Bissada, 2018).

In the last World classification workshop, the authors adopted Cairo (Cairo et al, 2011) classification as the new classification system for GRs defects (Cortellini and Bissada, 2018). Cairo has defined tree recession types (RTs) based on the interproximal clinical attachment level as the major criterion to make the GR diagnosis and to predict root coverage (RC).

The prevalence and the distribution of GRs were widely investigated in the literature and heterogeneous results were reported. The prevalence of GRs varied from 15 % to 99.7 % (Röthlisberger et al, 2007; Rios et al, 2014).

Different etiological factors of GRs were identified in the literature. They could be categorized into four categories: anatomical, pathological, traumatic or iatrogenic factors (Cortellini & Bissada, 2018; Amine et al, 2019). These factors could be interrelated leading to the development of GR defects. Hence, in most cases, we could identify more than an etiological factor. Therefore, the presence of one of these factors may increase the potential risk of developing GRs. Different risk indicators

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were reported in the literature in different populations. Among these risk indicators, age has been mostly associated with the presence of GRs (Albandar & Kingman, 1999; Susin et al, 2004; Romandini et al, 2020; Vignoletti et al, 2020; Romano et al 2022). Other risk indicators were also reported in previous epidemiological studies including gender, cigarette smoking, high level of education and traumatic tooth brushing (Susin et al, 2004; Rios et al 2014; Romandini et al, 2020; Vignoletti et al, 2020; Romano et al 2022).

Periodontitis is a chronic plaque-induced inflammatory disease characterized by clinical and radiographic attachment losses (Papapanou et al, 2018). GR is a common clinical feature of advanced cases of periodontitis especially in thin scalloped periodontal biotypes. Patients with destructive periodontal diseases may have an increased risk of developing GRs (Susin et al, 2004; Romano et al, 2022). The objective of this work is to explore the prevalence, distribution and risk indicators of GRs in periodontitis patients.

2. Materials and methods

2.1. Study design and patients

The present study was based on a retrospective examination of dental files of 400 periodontitis patients at the Periodontics Department of the Faculty of Dentistry of Casablanca - University of Hassan II - Casablanca, Morocco.

2.2. Inclusion criteria

- Periodontitis files archived at the department between 2016 and 2021.
- Complete dental file including X-rays (panoramic radiography and full mouth *peri*-apical radiographs) and photographs.

2.3. Exclusion criteria

- Incomplete dental files
- Patients who have an absence of a tooth group

2.4. Data collection

- The operating sheet used to collect data includes the following subject-level variables.
- Age: in years.
- Sex: female, male.
- Current smoking behavior: No, 1–9 cigarettes/day, ≥10 cigarettes/day.
- Socio-economic level: low, medium and high.
- Chief complaint: Bleeding, Gingival recession, tooth mobility, tooth sensitivity, halitosis, addressed by other departments, pain, oral cavity care, supportive periodontal therapy, pathologic tooth migration and tooth loss.
- General health status: diabetes mellitus, cardiovascular diseases, osteoporosis, chronic kidney disease, depression and others.
- Medications: anti-diabetics, anti-hypertensives, anti-inflammatory, others.
- Tooth brushing frequency: Never, 1–2 times a day, 2–3 times a day.
- Interdental brushing: Interdental brush, dental floss.
- The level of plaque control: Inadequate plaque control was defined as a mean plaque index of ≥ 1.5 (Silness and Loe, 1964)
- Occlusal status: It was recorded using Angle's Classification (Angle, 1899), overbite and overjet (in millimeters).
- Clinical form of periodontitis: In all files, the periodontal examination was evaluated at six sites/ tooth on all permanent teeth (except third molars). The attachment loss (AL) was calculated to make a periodontal disease diagnosis. The AL was defined as the sum of pocket probing depth (PPD) and gingival recession, or as the difference between PPD and gingival enlargement. Two classifications were used:
  - Aggressive and chronic periodontitis (AAP 1999) (Armitage, 1999).
  - Periodontal disease classification (EFP/AAP 2017) (Papapanou et al, 2018).
- Gingival recession (GR): GRs were recorded at the buccal aspect of the tooth using the classification of Cairo (Cairo et al, 2011).
- Recession Type (RT): RT1, RT2, RT3.

One experienced operator (EW) defined the clinical form of periodontitis and RT based on the files' clinical recording, radiographs and photographs.

2.5. Statistical analysis

Descriptive statistics include frequencies, means and standard deviations. Prevalence of GR was calculated at the patient level. Univariate logistic regression analysis was performed to identify risk indicators of GRs. Multivariate regression analysis was conducted for selected variables with $p < 0.05$. SPSS (Statistical Package for the Social Sciences) was used to perform statistical analyses.

3. Results

The characteristics of the patients' sample are shown in Table 1. The study patients comprised 293 (73.3 %) females and 107 (26.8 %) males. The mean age of the patients' sample was 41.56 ± 13.17 (range: 14–73; median: 42). 291 (72.75 %) patients have a low socio-economic level, 59 (14.75 %) have a medium socio-economic level and only 2 (0.5 %) patients have a high socio-economic level. Among 400 patients, only 2 (0.5 %) patients are smokers. The duration of smoking was estimated to be 2–3 years.

3.1. General health status

306 (76.5 %) patients are healthy, 23 (5.7 %) patients have a diabetes mellitus, 24 (6 %) patients have cardiovascular diseases, 7 (1.7 %) patients have depression, 3 (0.8 %) patients have osteoporosis, 3 (0.8 %) patients have a chronic kidney disease and 34 (8.5 %) patients suffer from other diseases (Table 2). Regarding medication consumption; 17 (4.3 %) diabetes patients take anti-diabetics, 12 (3 %) patients take anti-hypertensives, 10 (2.5 %) patients take anti-inflammatory drugs and 28 (7 %) patients take other medications.

Table 1
Descriptive statistics of the patients' sample.

Variable	n	%
Gender	107	26.8
Male	293	73.3
Female		
Socio-economic level	291	72.75
Low	59	14.75
Medium	2	0.5
High		
Current smoking behavior No	398	99.5
1–9 cigarettes/day	1	0.25
≥10 cigarettes/day	1	0.25
Tooth brushing frequency	24	7.1
Never	279	82.3
1–2 times a day	36	10.6
2–3 times a day		
The level of plaque control	120	30
Adequate	265	66.3
Inadequate		

Table 2
General health status of the patients' sample.

Medical Conditions	n	%
Healthy	306	76.5
Diabetes Mellitus	23	5.7
Cardiovascular Diseases	24	6.0
Depression	7	1.7
Osteoporosis	3	0.8
Chronic Kidney Disease	3	0.8
Other Diseases	34	8.5

3.2. Clinical form of periodontitis according to AAP 1999 and EFP/AAP 2017 classifications

117 (29.25 %) and 283 (70.75 %) patients have aggressive periodontitis (AgP) and chronic periodontitis (ChP) respectively. 6 (1.5 %) patients have a periodontitis stage I, 110 (27.5 %) patients have a periodontitis stage II, 273 (86.5 %) patients have a periodontitis stage III and 9 (2.3 %) patients have a periodontitis stage IV (Table 3). 115 (28.7 %) patients have a periodontitis grade A, 245 (61.3 %) patients have a periodontitis grade B and 35 (8.8 %) patients have a periodontitis grade C (Table 3).

3.3. Prevalence of gingival recessions (GRs)

Among 400 patients, 354 (88.5 %) patients have at least one GR $\geq$ 1 mm. The prevalence of recession type (RT) at the patient level was 0.5 %, 2.25 % and 85.75 % for RT1, RT2 and RT3 respectively. As shown in Fig. 1, lower incisors are the most affected teeth (79.8 %). Upper canines present the lowest frequency (41.8 %).

3.4. Chief complaint and the perception of gingival recessions (GRs)

Among 354 patients presenting at least one GR, only 28 (7 %) patients consulted for GR. Oral cavity care was the most frequent chief complaint (45 %). Only 1 (0.3 %) patient suffered from tooth sensitivity (Fig. 2).

3.5. Dental hygiene

The mean value of plaque index (PI) was 1.79 $\pm$ 0.58. Only 120 (30 %) patients have adequate plaque control. Regarding interdental brushing, only 5 (1.3 %) patients used dental floss. No one used interdental brushes (Table 1).

Table 3
Frequency of subjects by clinical form of periodontitis according to AAP 1999 and EFP/AAP 2017 classifications.

Clinical form of periodontitis	n	%
AAP 1999 Classification		
AgP	117	29.25
ChP	283	70.75
EFP/AAP 2017 Classification		
Periodontitis S I	6	1.5
Periodontitis S II	110	27.5
Periodontitis S III	273	68.3
Periodontitis S IV	9	2.3
Periodontitis Gr A	115	28.7
Periodontitis Gr B	245	61.3
Periodontitis Gr C	35	8.8
Extent	19	4.75
Localized	381	95.25
Generalized		

AgP: Aggressive periodontitis; ChP: Chronic periodontitis; S: Stage; Gr: Grade.

3.6. Occlusal status

The mean value of overbite and overjet was 2.47 $\pm$ 1.31 and 2.46 $\pm$ 1.49 respectively and most patients have Angle class 1.

3.7. Risk indicators

Table 4 demonstrated adjusted SEs for each patient-related factor associated with GR. The univariate logistic regression showed that age (SE = 0.021; 95 % CI 1.01–1.10; p = 0.006), plaque index (SE = 0.50; 95 % CI 1.49–10.50; p = 0.006), level of plaque control (SE = 0.529; 95 % CI 0.90–0.72; p = 0.010) and periodontitis stage (SE = 0.41; 95 % CI 1.41–7.07; p = 0.005) were significantly associated with the presence of GR. In the multivariate regression model, significant results were confirmed only for age (SE = 0.021; 95 % CI 1.02–1.17; p = 0.006) and periodontitis stage (SE = 0.41; 95 % CI 1.35–6.75; p = 0.007).

4. Discussion

4.1. Prevalence

The present work was based on a retrospective examination of dental files of periodontitis patients using a multivariable analytical model. There is no previous study evaluating the prevalence and risk indicators of GRs in Morocco. Out of the 400 patients, 354 (88.5 %) patients have at least one GR $\geq$ 1 mm. The high prevalence reported in the present work is attributed to the periodontal status of patients (periodontitis patients). Romano et al (Romano et al, 2022) reported that periodontitis was a risk indicator for RT2 and RT3 GRs. According to the literature, the prevalence of GRs varied from 15 % to 99.7 % (Röthlisberger et al, 2007; Rios et al, 2014). A systematic review by Vikender Singh Yadav et al (Vikender et al., 2022) reported that more than 2/3 of the population presents at least one GR $\geq$ 1 mm; a prevalence of 75.42 % was reported for buccal GRs. Albandar and Kingman (Albandar & Kingman, 1999) reported that 23.8 million of adult subjects in the United States of America have at least one GR $\geq$ 3 mm. More recently, Romandini et al (Romandini et al, 2020) showed that 91.6 % of adults in the United States of America have at least one GR $\geq$ 1 mm. In a Brazilian population, Susin et al (Susin et al, 2004) reported a prevalence of 51.6 % (GR $\geq$ 3 mm). The prevalence reported in our study is in agreement with data from Matas et al (Matas et al, 2011) who reported a prevalence of 85 %. Serino et al (Serino et al, 1994), in a Swedish population, reported a prevalence of 25 %. This low prevalence could be explained by the preventive program adopted by the public dental service. The variety of prevalence between epidemiological studies may be associated with the difference in studies samples and the prevalence of GRs definition.

4.2. Distribution

The prevalence of GR was higher in the lower incisors area (79.8 %). These data are in accordance with the data found by Matas et al (Matas et al, 2011), Manchala et al (Manchala et al, 2012) and Romandini et al (Romandini et al, 2020). Manchala et al (Manchala et al, 2012) reported that lower incisors were the most affected teeth (GR $\geq$ 1 mm) with a prevalence of 61 %. However, other surveys showed a higher prevalence in the upper premolar and molar area (Serino et al, 1994; Röthlisberger et al, 2007; Slutzkey and Levin, 2008; Vignoletti et al, 2020). Fragkioudakis et al (Fragkioudakis et al., 2021) showed that lower left canines and left fist premolars were the most affected teeth by GRs.

The lower incisors area is generally characterized by a thin scalloped biotype, which could justify the high prevalence observed in this area of the mouth.

4.3. Risk indicators

The literature data reported that the prevalence of GRs augments

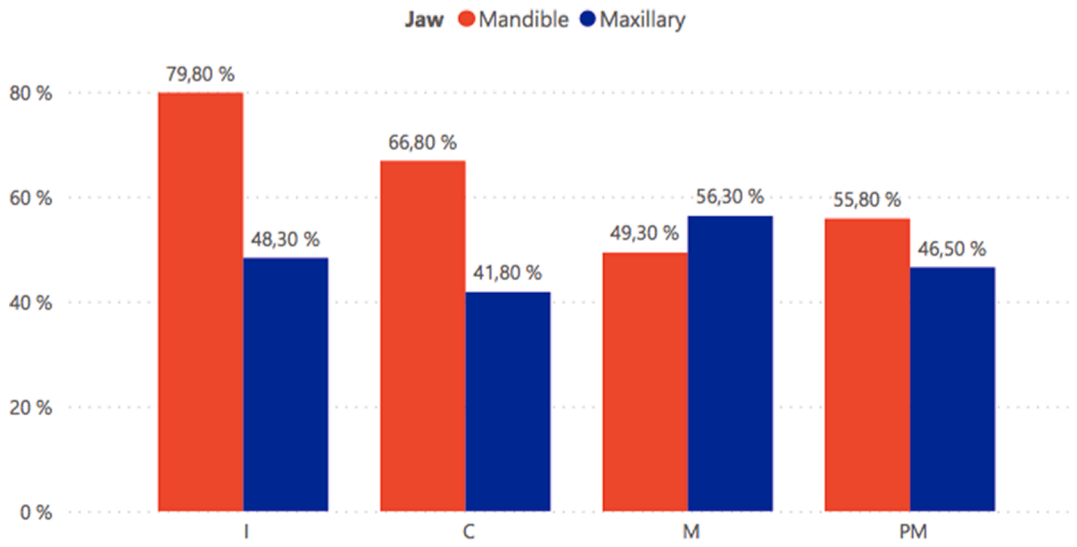

Fig. 1. Distribution of gingival recessions I: Incisor, C: Canine, PM: Premolar, M: Molar.

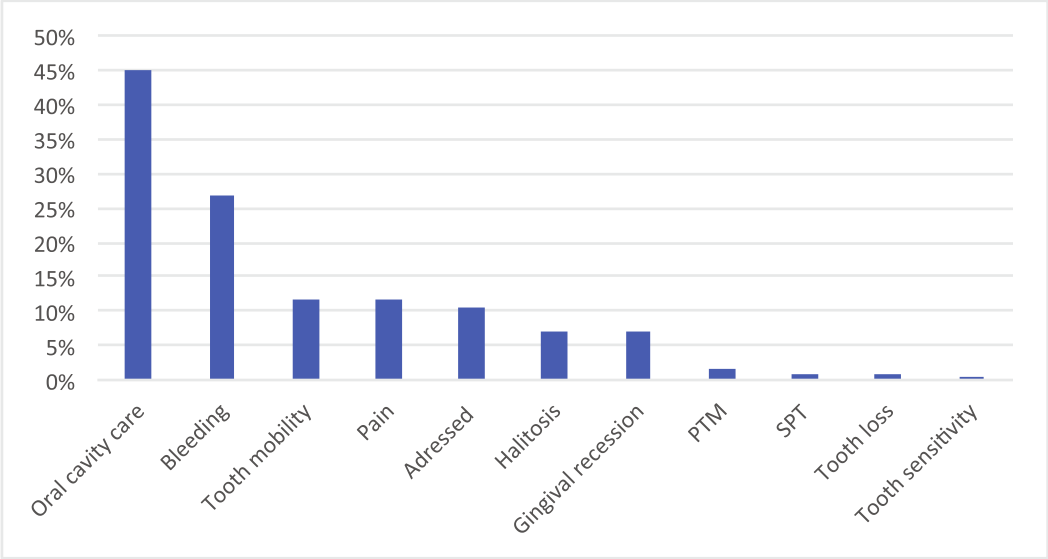

Fig. 2. Prevalence of chief complaints.

Table 4
Univariate and multivariate logistic regression with presence of gingival recessions.

Variable	Univariate regression			Multivariate regression		
	SE	95 % CI	p	SE	95 % CI	p
Gender	0.761	0.08–1.57	0.171			
Age	0.021	1.01–1.10	0.006*	0.021	1.02–1.17	0.006*
Plaque index	0.50	1.49–10.50	0.006*	0.83	0.49–12.52	0.271
The level of plaque control	0.529	0.90–0.72	0.010*	0.88	0.09–2.88	0.447
Clinical form of periodontitis	0.51	0.65–4.68	0.275			
Periodontitis stage	0.41	1.41–7.07	0.005*	0.41	1.35–6.75	0.007*
Periodontitis grade	0.45	0.98–5.68	0.560			
Extent	0.97	0.61–13.57	0.183			
Overbite	0.23	0.51–1.26	0.333			
Overjet	0.21	0.74–1.70	0.586			
R-CAC	0.46	0.51–3.25	0.602			
L-CAC	0.56	0.58–5.13	0.998			
R-MAC	0.66	0.52–6.99	0.332			
L-MAC	0.51	0.46–3.33	0.677			

R-MAC; Right Molar Angle Class; L-MAC: left Molar Angle Class; R-MAC: Right Canine Angle Class; L-CAC: Left Canine Angle Class.
* Statistically significant.

with age, and it is more prevalent in males than females (Susin et al, 2004; Toker and Ozdemir, 2009). Nevertheless, in our work, no association was demonstrated between gender and the presence of GRs. These findings are in agreement with the data by Fragkioudakis el al (Fragkioudakis et al., 2021) that reported no statistical difference between females and males in a young patients sample. Data from our work showed a statistically significant positive association between age and the presence of GRs. Age resulted as a risk indicator in both univariate and multivariate logistic regression (SE = 0.021). These data are in accordance with the study of susin et al (Susin et al, 2004) who reported a nonlinear relationship between GRs with age. Vignoletti et al (Vignoletti et al, 2020), in their study conducted on 251 subjects attending a school of dentistry and dental hygiene in Italy, found that age was the unique factor associated with GRs. Romandini et al (Romandini et al, 2020) showed that patients aged 35–49 years were at higher risk of the development of RT 1 GRs. Other epidemiological studies showed that age is an important risk indicator of GRs (Sarfati et al, 2010; Teixeira et al., 2018; Romano et al, 2022).

The level of plaque control resulted as a risk indicator only in univariate logistic regression. A mean plaque index of ≥ 1.5 was a risk indicator for the presence of GRs. Our data are in agreement with the findings by Tocker et al (Toker and Ozdemir, 2009) who showed that high level of bacterial plaque was significantly associated with GRs. Romano et al (Romano et al, 2022) reported that a full-mouth plaque score of less than 30 % was a risk indicator for RT1 GRs and a full-mouth plaque score upper than 60 % was a risk indicator for RT2 and RT3 GRs.

Data from the literature showed that GRs are more prevalent in cases with advanced periodontal diseases (Susin et al, 2004; Romano et al, 2022). Based on our information, there is no previously published data evaluating the association between periodontitis stage and GRs. Data from our study showed a statistically significant positive association between periodontitis stage and GRs. Periodontitis stage resulted as a risk indicator of GRs in both univariate and multivariate logistic regression. The periodontitis stage includes a description of the severity of the disease (Papapanou et al, 2018; Tonetti et al, 2018). The advanced attachment loss observed in advanced stages of periodontitis may explain this association with the presence of GRs.

4.4. Study limitations

Numerous studies showed that cigarette smoking is a risk indicator of GRs (Manchala et al, 2012; Nikolaos and Chrysanthakopoulos, 2014). In the present study, only 2 (0.5 %) patients are smokers. Hence, it was not possible to evaluate the association of cigarette smoking with the presence of GRs.

Furthermore, no data on the progression and the incidence of GRs were possible to be assessed due to the cross-sectional design of this work.

5. Conclusion

This retrospective cross-sectional study reports a high prevalence of GRs (88.5 %) in a sample of 400 periodontitis patients. Lower incisors were the most affected teeth (79.8 %). Most patients have advanced GRs with advanced interproximal attachment loss (RT3 GRs).

Age, plaque index, the level of plaque control and periodontitis stage were the risk indicators of GRs in the studied population.

6. Author statement

All authors have made substantial contributions to the conception and design of the study. Wafa El Kholti, Safaa Boubdir, Sihame Chemlali and Jamila Kissa have been involved in the acquisition of data. Wafa El Kholti and Zineb El Jalil have been involved in data analysis and interpretation. Wafa El Kholti and Lobna Rhalimi have been involved in drafting the manuscript. Wafa El Kholti, Safaa Boubdir, Zineb El Jalil, Loubna Rhalimi, Sihame Chemlali, Abdallah Mound, Touria Aboussaouira and Jamila Kissa contributed to critically revising the article and have given final approval of the version to be published.

We further confirm that the order of authors listed in the manuscript has been approved by all of us.

Ethical statement

This study was conducted on patients files. It does not require ethical statement.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Albandar, J.M., Kingman, A., 1999. Gingival recession, gingival bleeding, and dental calculus in adults 30 years of age and older in the United States, 1988–1994. J. Periodontol. 70 (1), 30–43.

Amine K, El Kholti W, Kissa J. Periodontal root coverage. An Evidence-Based Guide to Prognosis and Treatment. Springer Edition;2019:9-21.

Angle, E.H., 1899. Classification of malocclusion. Dent. Cosmos. 41, 248–264.

Armitage, G.C., 1999. Development of a classification system for periodontal diseases and conditions. Ann. Periodontol. 4, 1–6.

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. J. Clin. Periodontol. 38, 661–666.

Cortellini, P., Bissada, N.F., 2018. Mucogingival conditions in the natural dentition: Narrative review, case definitions, and diagnostic considerations. J. Clin. Periodontol. 45 (Suppl 20), S190–S198.

Fragkioudakis, I., Tassou, D., Sideri, M., Vouros, I., 2021. Prevalence and clinical characteristics of gingival recession in Greek young adults: A cross-sectional study. Cllin. Experimental Dent. Res. 1–7.

Manchala, S.R., Vandana, K.L., Mandalapu, N.B., Mannem, S., Dwarakanath, C.D., 2012. Epidemiology of gingival recession and risk indicators in dental hospital population of Bhimavaram. J. Int. Soc. Prevent. Communit. Dent. 2, 69–74.

Matas F, Sentís J, Mendieta C. Ten-year longitudinal study of gingival recession in dentists. J Clin Periodontol. 2011;38 (Suppl)12:1091–1098.

Nikolaos A and Chrysanthakopoulos. Gingival recession: Prevalence and risk indicators among young Greek adults. J Clin Exp Dent. 2014;6(3):e243-9.

Papapanou, P.N., Sanz, M., et al., 2018. Periodontitis: Consensus report of Workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J. Clin. Periodontol. 45 (Suppl 20), S162–S170.

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 cession in the population of adults from Porto Alegre, Brazil. J. Clin. Periodontol. 41 (Suppl 11), 1098–1107.

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. J. Clin. Periodontol. 47, 1180–1190.

Romano, F., Perotto, S., Baima, G., et al., 2022. Estimates and multivariable risk assessment of mid-buccal gingival recessions in an Italian adult population according to the 2018 World Workshop Classification System. Clin. Oral Invest. 26, 4769–4780.

Röthlisberger, B., Kuonen, P., Salvi, G.E., et al., 2007. Periodontal conditions in Swiss army recruits: a comparative study between the years 1985, 1996 and 2006. J. Clin. Periodontol. 34 (Suppl 10), 860–866.

Sarfati, A., Bourgeois, D., Katsahian, S., Mora, F., Bouchard, P., 2010. Risk assessment for buccal gingival recession defects in an adult population. J. Periodontol. 81 (Suppl 10), 1419–1425.

Serino, G., Wennström, J.L., 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, 57–63.

Silness, J., Loe, H., 1964. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. Acta Odontol. Scand. 22, 121–135.

Slutzkey, S., Levin, L., 2008. Gingival recession in young adults: occurrence, severity, and relationship to past orthodontic treatment and oral piercing. Am. J. Orthodont. Dentofac. Orthoped. 134 (Suppl 5), 652–656.

Susin, C., Haas, A.N., Oppermann, R.V., Hangerjirden, O., Albanadar, J.M., 2004. Gingival recession: epidemiology and risk indicators in a representative urban Brazilian population. J Peridontol. 75 (10), 1377–1386.

Teixeira, D.N.R., Zeola, L.F., Machado, A.C., et al., 2018. Relationship between noncarious cervical lesions, cervical dentin hypersensitivity, gingival recession, and associated risk factors: a cross-sectional study. J. Dent. 76, 93–97.

Toker, H., Ozdemir, H., 2009. Gingival recession: epidemiology and risk indicators in a university dental hospital in Turkey. Int. J. Dent. Hyg. 7 (Suppl2), 115–120.

Tonetti, M.S., Greenwell, H., Kornman, K.S., 2018. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. J. Clin. Periodontol. 45 (Suppl 20), S149–S161.

Vignoletti, F., Di Martino, M., Clementini, M., Di Domenico, G.L., de Sanctis, M., 2020. Prevalence and risk indicators of gingival recessions in an Italian school of dentistry and dental hygiene: a cross-sectional study. Clin. Oral Invest. 24, 991–1000.

Vikender, S.Y., Bhumika, G., Kanika, M., et al., 2022. Global prevalence of gingival recession: A systematic review and meta-analysis. Oral Dis.