


# Relationship Between Staging and Grading of Periodontitis and Periimplantitis: A Retrospective Study

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## ABSTRACT

**Objective:** The purpose of this retrospective study was to determine the relationship between peri-implantitis and stage/grade of periodontitis.

**Methods:** Records of 171 periodontitis patients with 318 dental implants were screened. Classification of diagnosed patients with periodontitis were done by both stage (1, 2, 3 and 4) and grade (A, B and C). The conditions of the peri-implant tissues were assessed as no peri-implantitis or peri-implantitis. Marginal bone loss severity of implants diagnosed with peri-implantitis, prosthesis type (single, bridge), location of dental implants (maxilla, mandibula, anterior and posterior), smoking (yes/no) and diabetes history (yes/no) of the patients were also evaluated. Analysis was done at implant level.

**Results:** A total of 203 (63.8%) dental implants were diagnosed with peri-implantitis. There were statistical differences in the stage and grade of periodontitis between implants diagnosed with no peri-implantitis and peri-implantitis ( $p < .05$ ). All of the dental implants in stage 4 periodontitis patients were diagnosed with peri-implantitis. Staging (1/2 versus 3/4) and grading (A/B versus C) of periodontitis had significant effects on the marginal bone loss of implants (radiographically  $\geq 25\%$  or  $< 25\%$  of the implant length) diagnosed with peri-implantitis. The marginal bone loss risk increased 3.86 times in stage 3/4 compared to stage 1/2 and 3.16 times in patients with grade C periodontitis compared to grade A/B.

**Conclusion:** The outcome of this study indicates that peri-implantitis was quite prevalent in dental implant patients with periodontitis, depending on the stage/grade. The severity of peri-implant marginal bone loss of implants was related to higher-level staging and grading of periodontitis.

**Keywords:** Alveolar bone loss, peri-implantitis, periodontitis

## 1. INTRODUCTION

Periodontitis is a widespread disorder; the severe form of periodontitis ranks 6th as one of the most common diseases (1). A questionnaire published in 2015 revealed that almost 50% of the adult (aged  $\geq 30$  years) population present periodontitis. Additionally, the incidence of periodontitis is 68% in individuals aged  $\geq 65$  years (2). It has a multifactorial mechanism in which host response, environmental and acquired factors, local factors, drugs used, genetic predispositions play an important role, usually pathogenic bacteria.

Peri-implantitis is a pathogenic condition that causes the progressive bone loss around dental implants (3). In the literature, there are similarities in the pathogenesis and etiology of periodontitis and peri-implantitis. The etiology of both diseases is thought to be due to the presence of a microbial biofilm (4). Peri-implantitis and periodontitis are both chronic inflammatory diseases due to a biologically destructive interplay between subgingival microbial biofilm and the host immunoinflammatory response, which can cause destruction of tooth/implant supporting tissue and result in tooth/implant loss. In the 2017 World Workshop,

there is significant evidence that patients with a history of periodontitis, a lack of routine maintenance treatment, and poor biofilm control are more likely to acquire peri-implantitis (3). Potential theories for the relation between periodontitis and peri-implantitis include that periodontitis patients may have a defective host immune response, more pathogenic bacterial species, or a greater bacterial load (5). A number of studies have examined the peri-implantitis prevalence and its correlations with either current periodontitis or a history of periodontitis. In a 10-year cohort clinical trial (6), 45 patients who had no previous periodontitis history and 8 patients underwent implant treatment after their periodontal treatments were completed, and the 10-year peri-implantitis incidence was 29% in patients with periodontitis compared to 6% in the non-periodontitis subjects. In a systematic review (7), patients with periodontitis had a higher overall percentage of biologic complications, such as implant loss, compared to non-periodontitis patients. Daubert et al.(8) revealed that severe form of periodontitis was significant risk indicator with an unadjusted risk ratio of 7 of all examined variables for peri-implantitis. According to a review (3),

there are studies reporting that the risk of developing peri-implantitis is not associated with patients with a history of periodontitis (aggressive or chronic) and associated with an increase of 2.2-19 times. Derks et al. (9) reported a risk ratio of 4 for moderate/severe peri-implantitis in patients with current periodontitis in a 9-year follow-up of 588 patients. There are also studies stating that periodontitis is not related to peri-implantitis (10, 11). A cross sectional study (11) involving 134 patients failed to show an increased risk of peri-implantitis patients who had a history of periodontitis. There are limited studies examining the association between peri-implantitis and periodontitis based on the latest classification. Ravida et al. (12) reported that there was an association between the grade of periodontitis and the occurrence of implant failure. Yamazaki et al. (13) found that the peri-implant disease prevalence was higher in patients who had Stage 4 periodontitis. Considering the World Workshop in 2017 periodontitis and peri-implantitis case definitions could lead to more accurate comparisons and analyzes to explore in revealing potential associations. Thus, in this retrospective study, it was aimed to determine the association between the stage and grade of periodontitis and the presence and severity of peri-implantitis.

## 2. METHODS

The ethical approval of the present retrospective study was granted by the Clinical Research Ethics Committee of Faculty of Dentistry Marmara University (Protocol number: 2022.092). The protocol of this study was in accordance with the principle stated in the Helsinki Declaration of 1975, as revised in 2013. The data was collected from patient charts, both physical and electronic, received between January 2018 and September 2022 at the Faculty of Dentistry, Marmara University, Turkey. For inclusion in the present study, subjects had to fulfill the following criteria: patient with one or more implants in functions for at least 1 year, patients with fixed prosthesis placed on dental implants, patients diagnosed with periodontitis, patient with reliable and available demographic, medical, radiographical and periodontal data. The exclusion criteria were as follows: non-periodontitis patients, patients who use overdentures or all-on-four/six, patients with unclear or incomplete data.

Periodontitis was identified according to Word Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions in the 2017 (14). The current classification is based on the stages and grades of periodontitis. In staging, the severity and extent of periodontitis were assessed in this study. The severity of periodontitis was based on the periodontal breakdown of the worst-affected tooth and classified as Stages 1, 2, 3, and 4. Generalized, localized (<30% of teeth affected) and molar/incisor pattern are three categories used to describe the extent of periodontitis. Grade of periodontitis is determined using indirect evidence of progression rate. Bone loss at the worst-affected tooth (calculated as radiographic bone loss which is a percentage of root length divided by the patient's age) in the dentition

as a function of age. Grade A is characterized as a slow rate of progression, Grade B as having a moderate rate of progression and Grade C as having a rapid rate of progression.

Case definition of peri-implantitis was made according to current classification system of peri-implant diseases and conditions guidelines (15). In this study, implants were evaluated for the peri-implantitis or no peri-implantitis. Moreover, the most coronal implant-bone contact point was determined radiographically to represent the interproximal marginal bone level and was quantified as a percentage of implant length to categorize the degree of bone loss (<25%, 25%-50% or >50% of the implant length) (12). The number of implants, their location (maxilla, mandibula, anterior and posterior) and prosthesis type (single, bridge), smoking (yes/no) and diabetes history (yes/no) of the patients were also assessed.

### 2.1. Statistical Analysis

Chi-squared test was applied for analysis of data. Binary logistic regression analysis was performed to determine associations between marginal bone loss of implants diagnosed with peri-implantitis and periodontal status (stage/grade). A statistical software package (SPSS v20.0 for Windows, IBM, Chicago, IL) was used for statistical analysis. Data analysis was done at the implant level. When  $p < .05$ , the differences were regarded as significant.

## 3. RESULTS

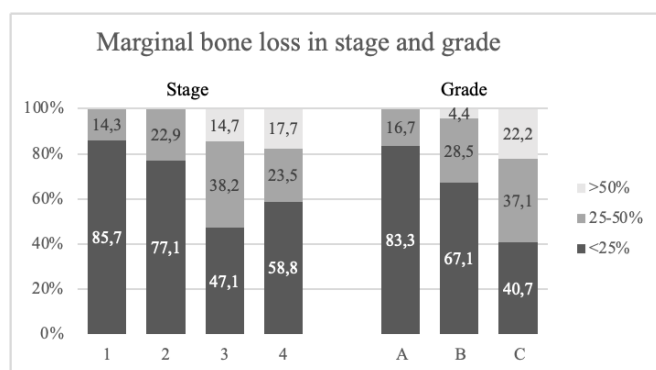
A total of 171 periodontitis patients with 318 implants composed of 105 (61.4%) females and 66 (38.6%) males, with a mean age of  $49.3 \pm 11.6$  years (range 21 to 74 years) were included in the present study. Most of the patients were non-smokers (84.0%) and only 10.2% had a history of diabetes. At implant level, 203 (63.8%) implants were diagnosed with peri-implantitis (Table 1). No statistically significant difference was detected between smoking status, presence of diabetes, and peri-implant health status ( $p > .05$ ). There was no significant difference between the locations and archs of the implants and the presence of peri-implantitis ( $p > .05$ ). There were statistical differences in the stage and grade of periodontitis between implants diagnosed with peri-implantitis and no peri-implantitis ( $p < .05$ ). Of the patients with peri-implantitis, 6.9% had stage 1 periodontitis, 34.5% stage 2, 50.2% stage 3 and 8.4% stage 4. All of the dental implants in stage 4 periodontitis patients were diagnosed with peri-implantitis. In terms of grading, patients diagnosed with peri-implantitis were 5.9% in grade A, 67.5% in grade B, and 26.6% in grade C. The extent of periodontitis was generalized in the majority of both the study population (79.6%) and patients diagnosed with peri-implantitis (82.7%). According to the severity of marginal bone loss, the distribution of implants with peri-implantitis in the stage and grade of periodontitis are presented in Figure 1 and Table 2 ( $p < .05$ ). Binary logistic regression model outcomes showed that grading (A/B versus C) and staging (1/2 versus 3/4) significantly affected the

marginal bone loss (>25%) of implants diagnosed with peri-implantitis (Table 3). The marginal bone loss risk increased 3.86 times in stage 3/4 compared to Stage 1/2 and 3.16 times in patients with grade C periodontitis compared to grade A/B.

**Table 1.** Comparison of demographic characteristics, periodontal status and features of the implant according to peri-implantitis status

Variables	Total N (%)	Peri-implantitis status		p
		Peri-implantitis N (%)	No Peri-implantitis N (%)	
Number of implants	318 (100.0)	203 (63.8)	115 (36.2)	
Smoking				.203
Yes	51 (16.0)	37 (18.2)	14 (12.2)	
No	267 (84.0)	166 (81.8)	101 (87.8)	
Diabetes				.341
Yes	32 (10.2)	18 (9.1)	14 (12.2)	
No	286 (89.9)	185 (91.1)	101 (87.8)	
Stage				.000
1	44 (13.8)	14 (6.9)	30 (26.1)	
2	109 (34.3)	70 (34.5)	39 (33.9)	
3	148 (46.5)	102 (50.2)	47 (40.0)	
4	17 (5.3)	17 (8.4)	0 (0.0)	
Grade				.000
A	39 (12.3)	12 (5.9)	27 (23.5)	
B	206 (64.8)	137 (67.5)	69 (60.0)	
C	73 (23.0)	54 (26.6)	19 (16.5)	
Extent				.058
Localized	64 (20.1)	34 (16.7)	30 (26.1)	
Generalized	254 (79.9)	169 (83.3)	86 (73.9)	
Arch				.908
Maxilla	162 (50.9)	104 (51.2)	58 (50.4)	
Mandible	156 (49.1)	99 (48.8)	57 (49.6)	
Position				.873
Anterior	50 (15.7)	33 (16.3)	17 (14.8)	
Posterior	268 (84.3)	170 (83.7)	98 (85.2)	
Prosthesis type				.482
Single-unit	145 (45.6)	96 (47.3)	49 (42.6)	
Multi-unit	173 (54.4)	107 (52.7)	66 (57.4)	

Chi-square test,  $p < .05$ .



**Figure 1.** Distribution of implants diagnosed with periimplantitis according to marginal bone loss severity in stage and grade periodontitis

**Table 2.** Comparison of marginal bone loss severity of implants diagnosed with periimplantitis with periodontal status

	Marginal Bone Loss N (%)				p
	Total N=203	<25 N=124	25-50 N=61	>50 N=18	
Stage					.000
1	14 (6.9)	12 (9.7)	2 (3.3)	0 (0.0)	
2	70 (34.5)	54 (43.5)	16 (26.2)	0 (0.0)	
3	102 (50.2)	48 (38.7)	39 (63.9)	15 (83.3)	
4	17 (8.4)	10 (8.1)	4 (6.6)	3 (16.7)	
Grade					.000
A	12 (5.9)	10 (8.1)	2 (3.3)	0 (0.0)	
B	137 (67.5)	92 (74.2)	39 (63.9)	6 (33.3)	
C	54 (26.6)	22 (17.7)	20 (32.8)	12 (66.7)	

Chi-square test,  $p < .05$ .

**Table 3.** Binary logistic regression analysis of  $\geq 25\%$  marginal bone loss of implants diagnosed with periimplantitis in association with periodontal status (stage/grade)

	OR	95% CI	p
Stage			
1-2	Ref	2.047-7.263	.000
3-4	3.856		
Grade			
A-B	Ref	1.659-6.007	.000
C	3.157		

OR:odds ratio; CI:confidence interval;  $p < .05$ .

#### 4. DISCUSSION

Modern dentistry is very interested in the biological issues that can arise with osseointegrated dental implants. Peri-implantitis is a pathological disorder that affects the tissues around dental implants and is characterized by a progressive loss of implant supporting bone and inflammation of the peri-implant connective tissue. There are conflicting findings in the data on prevalence and risk factors/indicators of peri-implantitis. In this retrospective study, the relationship between peri-implantitis and stage/grade of periodontitis was evaluated.

A history of periodontitis is a risk indicator or factor for peri-implantitis in the literature (15). According to a meta-analysis, patients with periodontitis had a 2.3 times higher risk of developing peri-implantitis than periodontally healthy individuals (16). Rocuzzo et al. (17) showed a peri-implantitis prevalence of 47.2% in severe periodontitis patients and 27% in moderate periodontitis patients. According to Pjetursson et al. (18), the periodontitis patients with residual periodontal probing depths  $\geq 5$  mm had significantly more risk for implant loss and peri-implantitis. In patients with severe periodontitis, residual probing depths  $\geq 6$ mm including  $>10\%$  of sites after treatment were found to be a significant risk factor for development of peri-implantitis. Additionally, implants applied to patients who had previously tooth loss due to periodontitis were significantly susceptible to develop peri-implantitis and showed 0.5 mm more marginal bone loss after 5 years (16). Most of the studies examining the relationship between periodontitis and peri-implantitis in

the literature are based on the classifications before 2017. Romandini et al. (19) used the AAP/CDC case definitions for periodontal status assessment and the 2017 World Workshop for the peri-implantitis definition. According to authors, peri-implantitis prevalence was 12.4% in healthy subjects and 27.9% in periodontitis patients. To best of our knowledge, there are only two publications evaluating the association between the new classification of periodontitis and peri-implantitis. Ravida et al. (12) found that the prevalence a peri-implantitis prevalence of 33.3% in stage 1 and 2, 17.2% in stage 3, and 35.5% in stage 4 periodontitis patients. Although there was an increasing trend for stage 4, they did not find a significant relationship between the peri-implantitis prevalence and severity of periodontitis. In a recent study, Yamazaki et al. (13) found that in stage 4 patients, peri-implantitis prevalence was significantly higher. In two previous studies, although the number of patients diagnosed with peri-implantitis in grade B and C periodontitis patients were higher than in grade A periodontitis patients, none of the differences were statistically significant. In the present study, peri-implantitis were higher in stage 3 and 4, and grade B and C periodontitis.

Since the case definitions in 2017 World Workshop for peri-implantitis did not support categorization between severity levels of peri-implantitis based on the extent of marginal bone loss. Ravida et al. (12) evaluated the severity of peri-implantitis in terms of the degree of marginal bone loss. The severity of marginal bone loss was radiographically categorized <25%, 25-50% or >50% of the implant length. The increased severity of marginal bone loss (>25%) was significantly affected by grade of periodontitis (C versus A/B), whereas not by staging. Patients having a previous history of Grade C periodontitis compared to Grades A/B experienced a 7.6-fold greater risk of severe marginal bone loss. In a recent research (19), marginal bone loss was calculated from radiographs by calculating the distance between the fixture/abutment joint and the marginal bone level with a digital caliper, and averaging the mesial and distal bone resorption. Marginal bone loss was assessed by classifying it as <3 mm and  $\geq 3$  mm, Stage 4 was found to be significantly higher in the marginal bone loss  $\geq 3$ mm group. Similar to previous studies, the severity of peri-implant marginal bone loss was also linked in this study to higher-level staging and grading of periodontitis.

Smoking has been linked to periodontal disease through a number of processes, including disruptions in the inflammatory and responses of the host to possible periodontal pathogens, changes to the subgingival microbial populations, and impaired tissue healing capacity that causes an unbalanced state of tissue homeostasis (20). According to Karoussis et al., (6) only 6% of implants in non-smokers had peri-implantitis, compared to 18% of all implants in smokers. While 3 cross-sectional researches confirm these outcomes, with odds ratios of 32 (21), 3 (22) and 5 (23), there are also studies reporting no higher risk in smokers (8, 24). Smoking does not currently appear to be a risk factor or signal for peri-implantitis, according to conclusive evidence (15). No

significant association was detected between peri-implantitis and smoking in the present study. This could be as a result of the limited number of smokers, the self-reporting of smoking histories utilized in this study, and the definition of smoking status.

Hyperglycemia-induced release of advanced glycation end products and a variety of common risk variables of a genetic, microbiological, and lifestyle character are among the mechanisms underlying correlations between diabetes mellitus and periodontal disease (25). According to several studies, an increased risk of peri-implantitis exists in diabetic patients. Ferreira et al. (16) showed that individuals with diabetes (24.13%) had a higher risk of developing peri-implantitis than non-diabetic patients (6.56%) and an OR of 1.9 was recorded. Daubert et al. (8) demonstrated a 3-fold risk for peri-implantitis in diabetes patients at the time of implant placement. Ravida et al. (12) recorded that 19.6% of individuals with peri-implantitis did not have a diagnosis of diabetes, while 29.6% had a diagnosis of diabetes, but this difference was not statistically significant. Recently, Romandini et al. (19) have failed to show an association between diabetes and peri-implantitis. Similarly, in this study, no association was showed between the diagnosis of diabetes and peri-implantitis. It is thought that there is a lack of power due to the low percentage of patients with a history of diabetes among patients included in the study. Additionally, it was stated in the 2017 World Workshop that there is not available evidence to determine whether diabetes is a peri-implantitis risk indicator or factor (15).

The risk factors of periimplantitis associated with the implant-supported prosthesis have been established in the literature. Ill-fitting/ill-designed fixed and cement retained restorations are considered as risk factors for periimplantitis (26). Previous studies (19, 27) have also noted a correlation between the presence of peri-implantitis and the type of restoration (single crowns versus bridges), which may be clarified by the more challenging accessibility to oral hygiene practices. Contrary to previous studies, in the present study, there was no difference between single and bridge prostheses in terms of the occurrence of peri-implantitis.

The main limitation of the present study is the use of existing data in the system due to its retrospective nature. Limitations include the absence of implant brand names in the records and the fact that each dental implant was placed and began to function at a different time. Moreover, there is strong evidence in the literature that the risk of developing peri-implantitis is increased in patients with poor plaque control skills and no regular maintenance care after implant therapy (15). Only the association was evaluated in this retrospective study, further prospective clinical researches are needed to investigate the cause-effect relationship.

## 5. CONCLUSION

The outcome of this study indicates that peri-implantitis was quite prevalent in dental implant patients with periodontitis,

depending on the stage/grade. The severity of peri-implant marginal bone loss of implants was related to higher-level staging and grading of periodontitis. Prior to receiving implant treatment, patients' periodontitis stage and grade may prove to be a useful risk indicator of developing periimplantitis. To support this conclusion, additional clinical research is necessary.

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## REFERENCES

- [1] Kassebaum NJ, Bernabe E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of severe periodontitis in 1990-2010: A systematic review and meta-regression. *J Dent Res.* 2014;93:1045-1053. DOI: 10.1177/002.203.4514552491
- [2] Eke PI, Dye BA, Wei L, Slade GD, Thornton-Evans GO, Borgnakke WS, Taylor GW, Page RC, Beck JD, Genco RJ. Update on prevalence of periodontitis in adults in the United States: NHANES 2009 to 2012. *J Periodontol.* 2015;86:611-622. DOI: 10.1902/jop.2015.140520.
- [3] Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. *J Periodontol.* 2018;89 Suppl 1:S267-S290. DOI: 10.1002/JPER.16-0350
- [4] Lafaurie GI, Sabogal MA, Castillo DM, Rincon MV, Gomez LA, Lesmes YA, Chambrone L. Microbiome and microbial biofilm profiles of peri-implantitis: A systematic review. *J Periodontol.* 2017;88:1066-1089. DOI: 10.1902/jop.2017.170123.
- [5] Kornman KS. Mapping the pathogenesis of periodontitis: A new look. *J Periodontol.* 2008;79:1560-1568. DOI: 10.1902/jop.2008.080213
- [6] Karoussis IK, Salvi GE, Heitz-Mayfield LJ, Bragger U, Hammerle CH, Lang NP. Long-term implant prognosis in patients with and without a history of chronic periodontitis: a 10-year prospective cohort study of the ITI Dental Implant System. *Clin Oral Implants Res.* 2003;14:329-339. DOI: 10.1034/j.1600-0501.000.00934
- [7] Ong CT, Ivanovski S, Needleman IG, Retzepi M, Moles DR, Tonetti MS, Donos N. Systematic review of implant outcomes in treated periodontitis subjects. *J Clin Periodontol.* 2008;35:438-462. DOI: 10.1111/j.1600-051X.2008.01207
- [8] Daubert DM, Weinstein BF, Bordin S, Leroux BG, Flemming TF. Prevalence and predictive factors for peri-implant disease and implant failure: a cross-sectional analysis. *J Periodontol.* 2015;86:337-347. DOI: 10.1902/jop.2014.140438
- [9] Derks J, Schaller D, Hakansson J, Wennstrom JL, Tomasi C, Berglundh T. Effectiveness of implant therapy analyzed in a Swedish population: Prevalence of peri-implantitis. *J Dent Res.* 2016;95:43-49. DOI: 10.1177/002.203.4515608832
- [10] Marrone A, Lasserre J, Bercy P, Brex MC. Prevalence and risk factors for peri-implant disease in Belgian adults. *Clin Oral Implants Res.* 2013;24:934-940. DOI: 10.1111/j.1600-0501.2012.02476
- [11] Rohn A, Aslroosta H, Akbari S, Najafi H, Zayeri F, Hashemi K. Prevalence of peri-implantitis in patients not participating in well-designed supportive periodontal treatments: a cross-sectional study. *Clin Oral Implants Res.* 2017;28:314-319. DOI: 10.1111/clr.12800
- [12] Ravid A, Rodriguez MV, Saleh MHA, Galli M, Qazi M, Troiano G, Wang HL, Moreno PG. The correlation between history of periodontitis according to staging and grading and the prevalence/severity of peri-implantitis in patients enrolled in maintenance therapy. *J Periodontol.* 2021;92:1522-1535. DOI: 10.1002/JPER.21-0012
- [13] Yamazaki M, Yamazaki K, Baba Y, Ito H, Loos BG, Takahashi K. The stages and grades of periodontitis are risk indicators for peri-implant diseases-A long-term retrospective study. *J Pers Med.* 2022;12. DOI: 10.3390/jpm12101723
- [14] Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. *J Periodontol.* 2018;89 Suppl 1:S159-S172. DOI: 10.1002/JPER.18-0006
- [15] Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. *J Clin Periodontol.* 2018;45 Suppl 20:S246-S266. DOI: 10.1111/jcpe.12954.
- [16] Ferreira SD, Martins CC, Amaral SA, Vieira TR, Albuquerque BN, Cota LOM, Esteves Lima RP, Costa FO. Periodontitis as a risk factor for peri-implantitis: Systematic review and meta-analysis of observational studies. *J Dent.* 2018;79:1-10. DOI: 10.1016/j.jdent.2018.09.010
- [17] Rocuzzo M, Bonino F, Aglietta M, Dalmaso P. Ten-year results of a three arms prospective cohort study on implants in periodontally compromised patients. Part 2: clinical results. *Clin Oral Implants Res.* 2012;23:389-395. DOI: 10.1111/j.1600-0501.2011.02309
- [18] Pjetursson BE, Helbling C, Weber HP, Matuliene G, Salvi GE, Bragger U, Schmidlin K, Zwahlen M, Lang NP. Peri-implantitis susceptibility as it relates to periodontal therapy and supportive care. *Clin Oral Implants Res.* 2012;23:888-894. DOI: 10.1111/j.1600-0501.2012.02474
- [19] Romandini M, Lima C, Pedrinaci I, Araoz A, Soldini MC, Sanz M. Prevalence and risk/protective indicators of peri-implant diseases: A university-representative cross-sectional study. *Clin Oral Implants Res.* 2021;32:112-122. DOI: 10.1111/clr.13684
- [20] Apatzidou DA. The role of cigarette smoking in periodontal disease and treatment outcomes of dental implant therapy. *Periodontol 2000.* 2022;90:45-61. DOI: 10.1111/prd.12449
- [21] Rinke S, Ohl S, Ziebolz D, Lange K, Eickholz P. Prevalence of periimplant disease in partially edentulous patients: a practice-based cross-sectional study. *Clinical oral implants research.* 2011;22:826-833. DOI: 10.1111/j.1600-0501.2010.02061
- [22] Becker J, John G, Becker K, Mainusch S, Diedrichs G, Schwarz F. Clinical performance of two-piece zirconia implants in the posterior mandible and maxilla: a prospective cohort study

- over 2 years. *Clinical oral implants research*. 2017;28:29-35. DOI: 10.1111/clar.12610
- [23] Roos-Jansaker AM, Renvert H, Lindahl C, Renvert S. Nine – to fourteen-year follow-up of implant treatment. Part III: factors associated with peri-implant lesions. *Journal of clinical periodontology*. 2006;33:296-301. DOI: 10.1111/j.1600-051X.2006.00908
- [24] Dvorak G, Arnhart C, Heuberger S, Huber CD, Watzek G, Gruber R. Peri-implantitis and late implant failures in postmenopausal women: a cross-sectional study. *J Clin Periodontol*. 2011;38:950-955. DOI: 10.1111/j.1600-051X.2011.01772
- [25] Darby I. Risk factors for periodontitis & peri-implantitis. *Periodontol 2000*. 2022;90:9-12. DOI: 10.1111/prd.12447
- [26] Kordbacheh Chanki K, Finkelstein J, Papapanou PN. Peri-implantitis prevalence, incidence rate, and risk factors: A study of electronic health records at a U.S. dental school. *Clin Oral Impl Res*. 2019;30:306-314. DOI: 10.1111/clar.13416
- [27] Rodrigo D, Sanz-Sanchez I, Figuero E, Llodra JC, Bravo M, Caffesse RG, Vallcorba N, Guerrero A, Herrera D. Prevalence and risk indicators of peri-implant diseases in Spain. *J Clin Periodontol*. 2018;45:1510-1520. DOI: 10.1111/jcpe.13017

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