

Periodontal Disease Severity, Tooth Loss, and Periodontal Stability in Private Practice

E Elemek

Department of Periodontology, Gelişim University Faculty of Dentistry, İstanbul, Turkey

ABSTRACT

Background: Periodontal disease diagnosis and its stability after treatment are still a field of interest for both researchers and clinicians. **Aims:** First aim of this study was to implement the new periodontal classification for the reflection of periodontitis severity in private practice. Second, periodontal stability and tooth loss were observed in patients who attended supportive periodontal therapy (SPT). **Patients and Methods:** A total of 454 patients were classified according to the new classification. To define periodontitis, patients were staged according to the clinical attachment level, and tooth and bone loss. Grading was also assessed by bone loss to age ratio, smoking, and/or presence of diabetes. Associations between periodontitis and age, gender, presence of diabetes, and smoking were also analyzed. Additionally, periodontal stability, tooth loss, and adherence to oral hygiene were recorded for those who attended SPT. **Results:** One hundred five patients were diagnosed as generalized gingivitis and 349 patients as periodontitis. Among them, 166 suffered from severe periodontitis (stage 3 or 4). Most of the patients had stage 3 grade C periodontitis (40.4%). Out of the 344 patients who attended SPT at least once, no treatment was needed in 57 (16.6%) patients who were accepted periodontally stable. Twenty-nine patients lost at least one tooth due to periodontal reason. **Conclusions:** According to the new periodontal classification, 47.6% of the patients had severe periodontitis (stage 3 or 4). Periodontal stability was observed in 16.6% of patients who attended SPT.

KEYWORDS: Periodontal disease diagnosis, periodontal stability, supportive periodontal treatment

Received: 22-Nov-2021;
Revision: 29-Dec-2021;
Accepted: 12-Jan-2022;
Published: 16-Jun-2022

INTRODUCTION

According to a consensus report of 2017 World Workshop, a patient with gingivitis can revert to a state of good health, but a periodontitis patient remains a periodontitis patient for life, even after following successful therapy, and requires lifelong supportive care to prevent recurrence of the disease.^[1] Among periodontal diseases, gingivitis is defined as $\geq 10\%$ bleeding on probing (BOP) in the absence of attachment loss. The extent is determined as localized if BOP is between 10% and 30% and generalized if BOP is $\geq 30\%$.^[2] Gingival health following treatment of gingivitis on an intact periodontium (absence of detectable attachment and/or bone loss) is defined as $< 10\%$ bleeding sites with probing depths ≤ 3 mm. For reduced and stable

periodontium periodontal stability is also described as the successful treatment through control of local and systemic risk factors, resulting in minimal ($< 10\%$ of sites) BOP, no probing depths of 4 mm or greater that bleed on probing, optimal improvement in other clinical parameters, and lack of progressive periodontal destruction.^[3]

Supportive periodontal therapy (SPT) is needed after completion of treatment to stop progression of disease and to prevent reinfection. The decision of a therapist

Address for correspondence: Dr. E Elemek, Cihangir Mah Şehit Jandarma Komando Er Hakan Öner Sk No: 1 Avcılar, İstanbul, Turkey. E-mail: eelemek@gelisim.edu.tr

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Elemek E. Periodontal disease severity, tooth loss, and periodontal stability in private practice. Niger J Clin Pract 2022;25:931-7.

Access this article online	
Quick Response Code: 	Website: www.njcponline.com
	DOI: 10.4103/njcp.njcp_1952_21

Downloaded from http://journals.lww.com/njcp by BhdMf5eP-HKav1 zEoum1tQIN4a+kLlHEZ9bstH04XMi0hCwvCX1AW nYQp/llqHHD33D00Q0Ry7T1vSFACI3VCA/OAVpDd8KKGK0V0ymy+78= on 10/28/2023

regarding their patient's readiness for SPT depends on a careful evaluation of the responses to oral hygiene instructions, and scaling and root planing together with the control of risk factors.^[4] According to the American Academy of Periodontology, SPT should include all components of a typical dental recall examination and should also include periodontal re-evaluation, supragingival, and subgingival removal of bacterial plaque and calculus, and retreatment of any sites showing recurrent or persistent disease.^[5] Studies have shown that only 2%–5% of teeth in patients treated for chronic periodontitis and under SPT are lost over a 5- to 10-year period.^[6,7] Response to treatment, and evaluation of local and systemic risk factors are the important components in assessing periodontal stability.^[4] Presence of dental plaque and BOP are the main determinants of periodontal stability.^[8] The absence of BOP is considered to indicate site stability.^[9]

Several risk factors such as smoking, diabetes mellitus, age, and poor oral hygiene are found to be related with periodontal diseases.^[10,11] To prevent recurrence and progression of the disease, these factors should also be evaluated during SPT. Smoking cessation has a positive effect for periodontal stability during SPT.^[12] An uncontrolled diabetes mellitus is also highly associated with initiation and progression of periodontal disease, and it is important to monitor patient on blood glucose levels during SPT to prevent tooth loss.^[13,14] Clinical studies show that high prevalence of periodontal disease is seen among people aged >65 years.^[15,16] According to a recent National Health Survey in the United States, a high prevalence of periodontitis in patients >30 years is estimated to be around 47% and increases up to 70% in individuals ≥65 years.^[17]

Accumulation of biofilm is well known to be caused by improper tooth brushing and interdental cleaning which results with gingival inflammation, the initial stage of periodontal breakdown. Poor oral hygiene significantly increases the risk of having periodontitis by fivefold compared with good oral hygiene.^[18] For that reason, in addition to systemic and local factors, a behavioral oral hygiene management should also be evaluated during SPT. Compliance for a given patient depends on their previous attitude toward their own health as well as the ability of practitioner to provide information and motivation urging patients to comply with SPT.^[5] As the goal is to maintain dentition and not to lose tooth, it is crucial to motivate patients about the importance of SPT. Because SPT is believed to balance oral hygiene standards,^[19] it has a crucial role to get a lifelong periodontal stability.

The new classification for periodontal diseases presented new definitions of clinical gingival health on an intact

periodontium, reduced but healthy periodontium after successful treatment, gingivitis and periodontitis (staging and grading).^[20] The implementation of new definitions will optimize diagnosis to apply more accurate treatment as well as prevention. Therefore, the aim of this study was to define health and diseases of periodontium according to the new classification and observe periodontal stability and tooth loss during maintenance therapy in private practice patients who applied mainly for periodontal treatment.

SUBJECTS AND METHODS

Four hundred and ninety-one patients who applied in private practice between January 2014 and 2021 mainly for periodontal reasons were retrospectively analyzed. Patients ≥18 years and having dental panoramic radiographs were included in this study. Exclusion criteria was patients <18 years, absence of periodontal clinical measurements and radiographs. All patients who applied for treatment signed an informed consent about the use of their personal clinical and radiographical data in a study. The study protocol was approved by the Research Ethical Board of Yeni Yüzyıl University, Turkey (2021/04-643).

Clinical and radiographic examination

Demographic information regarding age, sex, presence of systemic disease, smoking habit (non-smoker, current smoker), and history of periodontal tooth loss were recorded at the first appointment. Additionally, adherence to oral hygiene was also evaluated by observational (observed by the researcher) and behavioral (self-reported or observed behaviors such as changes in toothpaste weight) outcomes,^[21] and tooth loss due to periodontal reason were recorded during maintenance therapy. In clinical examination, gingival recession was measured as the distance between gingival margin and cemento-enamel junction.

Probing pocket depth (PPD) was measured as the distance from gingival margin to periodontal pocket base. When the gingival margin was coronal, clinical attachment loss (CAL) was measured as PPD plus gingival recession at six sites per tooth (excluding third molars) when gingival margin was apical to cemento-enamel junction (CEJ). Tactile sensation was used to detect CEJ when gingival margin was coronal to CEJ.

Periodontal probe with a 0.5 mm diameter (University of North Carolina PCPUNC15, Hu-Friedy Ins. Co, USA) was used for clinical examination. Bleeding on probing (BOP) was also assessed as the presence/absence of bleeding observed 30 s after probing and calculated as percentage. A single researcher (E. Elemek) evaluated panoramic radiographs for analysis of bone loss. *Image*

J (Wayne Rasband, National Institute of Health; USA) program was used to evaluate bone loss on digitalized radiographs with attention on magnification.

Definition of periodontal diseases

Data collected retrospectively was evaluated according to the new Classification for Periodontal and Peri-implant Diseases and Conditions.^[20] In the presence of interdental CAL due to endo-periodontal lesions, vertical root fractures, presence of caries or restorations or impacted third molars and at no more than one nonadjacent tooth patients were assessed according to the criteria of non-periodontitis diseases or conditions.^[2] In the absence of interdental CAL, the presence of buccal or oral recessions with PPDs were evaluated. If PPD was >3 mm, patients were suspected as periodontitis. However, when there is no PPD >3 mm, full mouth BOP was evaluated. Localized gingivitis was diagnosed to have 10%–30% BOP whereas generalized gingivitis have >30% BOP in the absence of attachment loss and no probing depth >3 mm.^[20]

For staging of periodontitis, radiographic examination, periodontal chart, and a periodontal history of tooth loss were evaluated. Because previous periodontal records were not available for more than 5 years, the bone/age ratio was calculated to determine grading. The worst affected tooth was used for this assessment. The presence of diabetes and smoking was also taken into consideration for grading.^[2]

Periodontal treatment

A periodontist should inform all patients about oral hygiene instructions including tooth brushing and interdental cleaning. Nonsurgical and surgical treatments were applied according to the severity of periodontal disease. After completion of active periodontal treatment and control of local and systemic factors, patients were placed in maintenance therapy. Follow-up treatments and observation time were also recorded.

Statistical analysis

All data were analyzed using Statistical Package for Social Sciences (SPSS Inc, Release 22.0 for Windows, Chicago, IL, USA). Descriptive statistics (means, standard deviations) were performed. The associations between periodontitis and other factors were analyzed using a Chi-squared test. Logistic regression was performed to evaluate odds ratio (with 95% confidence intervals) for selected variables. Results were assessed at a significance level of 0.05.

RESULTS

Out of the 491 patients, 37 patients were not evaluated as they had no radiographs. Therefore, the study population comprised of 454 patients.

Of them 211 (46.5%) were male and 243 (53.5%) were female. Mean age was 39.75 ± 11.74 years. According to the new Classification of Periodontal and Peri-implant Diseases and Conditions,^[20] 105 patients were diagnosed as generalized gingivitis and 349 patients as periodontitis [Table 1]. Distribution of periodontitis severity and progression rate is shown in Table 2. Most of the patients included in this study had stage 3 grade C periodontitis (40.4%).

Table 3 presents the associations between periodontitis and selected variables. Results of this study

Table 1: Demographic information of patients

	Total (n=454)	Generalized Gingivitis (n=105)	Periodontitis (n=349)
Mean age (years, \pm SD)	39.75 \pm 11.74	29.23 \pm 5.46	42.91 \pm 11.27
Female gender, n (%)	243 (53.5)	56 (53.3)	187 (53.6)
Diabetes, n (%)	20 (4.4)	–	20 (5.73)
Smokers, n (%)	92 (20.3)	3 (2.9)	89 (25.5)
History of periodontal tooth loss, n (%)	31 (6.8)	–	31 (8.9)

Table 2: Periodontitis severity and progression rate according to Caton *et al* 2018

	Grade A	Grade B	Grade C
Stage 1	78 (22.4%)	18 (5.2%)	20 (5.7%)
Stage 2	9 (2.6%)	17 (4.9%)	41 (11.7%)
Stage 3	–	9 (2.5%)	141 (40.4%)
Stage 4	–	1 (0.3%)	15 (4.3%)

Table 3: Association between periodontitis patients (n=349) and other factors

	Periodontitis (n)	Prevalence (%)	P
Gender			P=0.964
Male	162	76.8	
Female	187	77	
Age			P<0.001
<34	79	45.9	
35-44	145	93.5	
45-54	55	98.2	
55-64	56	98.2	
\geq 65	14	100	
Smoking			P<0.001
Current (former)	89	96.7	
Never	260	71.8	
Diabetes			P=0.012
Present	20	100	
Absent	329	75.8	
History of periodontal tooth loss			P=0.002
Yes	31	100	
No	318	75.2	

indicated that age, smoking, diabetes, and history of periodontal tooth loss can be correlated with periodontitis ($P < 0.05$).

Table 4: Risk analyses of odds ratio for periodontitis patients

	<i>P</i>	OR	95% CI	
			Lower	Upper
Age	$P < 0.001$			
<34				
35-44				
≥45		11.2	6.354	20.077
Smoking	$P < 0.001$			
Current (former)		11.6	3.601	37.614
Never				
Diabetes	$P < 0.05$			
Present		1.3	1.390	1.251
Absent				
History of periodontal tooth loss	$P < 0.05$			
Yes		1.3	1.404	1.259
No				

Analyses were performed to evaluate high-risk behavior of periodontitis and results demonstrated that patients >45 years were more likely to have periodontitis (Odds Ratio: 11.2 Lower: 6.354 Upper: 20.077). In addition, smokers were more prone to have periodontitis than non-smokers (OR: 11.6 Lower: 3.601 Upper: 37.614). Patients with diabetes (OR: 1.3 Lower: 1.390 Upper: 1.251) and with a history of periodontal tooth loss (OR: 1.3 Lower: 1.390 Upper: 1.251) were more susceptible to develop periodontitis [Table 4].

After completion of active periodontal treatment, all patients were recalled for SPT for every 3–6 months depending on the initial periodontal treatment applied. One hundred and ten subjects did not follow SPT. The remaining 344 patients who applied for recall treatment at least once were analyzed in detail.

At follow-up appointments, adherence to oral hygiene, need for additional treatments, and tooth loss due to periodontal reason were also analyzed in 344 patients.

Table 5: Patient characteristics who attended SPT at least once

	Periodontally stable patients ($n=57$)	Patients lost at least one tooth ($n=29$)
Mean age (years, ±SD)	39.07±10.50	52.34±11.98
Mean observation time (months, ±SD)	24.10±16.89	42.68±15.11
Adherence to oral hygiene by brushing only, n (%)	57 (100)	13 (45)
Adherence to oral hygiene by brushing + interdental cleaning, n (%)	51 (89.5)	–

Table 6: Association between periodontal stability, tooth loss, and other factors during SPT

	Periodontally stable patients ($n=57$) Prevalence (%)	<i>P</i>	Patients lost at least one tooth ($n=29$) Prevalence (%)	<i>P</i>
Gender		$P=0.262$		$P=0.219$
Male	22 (14.1)		10 (6.4)	
Female	35 (18.6)		19 (10.1)	
Age		$P=0.854$		$P < 0.001$
<34	21 (18.4)		3 (2.6)	
35-44	21 (17.5)		4 (3.3)	
45-54	7 (14.9)		7 (14.9)	
55-64	7 (13.7)		12 (23.5)	
≥65	1 (8.3)		3 (25)	
Smoking		$P=0.005$		$P=0.003$
Current (former)	6 (6.9)		14 (16.1)	
Never	51 (19.8)		15 (5.8)	
Diabetes		$P=0.173$		$P < 0.001$
Present	1 (5.3)		9 (47.4)	
Absent	56 (17.2)		20 (6.2)	
Adherence to oral hygiene by brushing only		$P < 0.001$		$P < 0.001$
Yes	55 (21.3)		13 (5)	
No	2 (2.3)		16 (18.6)	
Adherence to oral hygiene by brushing + interdental cleaning n (%)		$P < 0.001$		$P=0.006$
Yes	51 (77.3)		–	
No	6 (2.2)		29 (10.4)	

Table 7: Risk analyses of odds ratio for patients who lost at least one tooth during SPT

	P	OR	95% CI	
			Lower	Upper
Age	P<0.001			
<34				
35-44				
45-54				
≥55		2.2	1.596	3.076
Smoking	P<0.05			
Current (former)		3.1	1.427	6.709
Never				
Diabetes	P<0.001			
Present		13.7	5.010	37.600
Absent				
Adherence to oral hygiene by brushing only	P<0.001			
Yes				
No		5	1.976	9.345

Two hundred and forty-eight (75%) patients used toothbrush only for oral hygiene. Together with brushing, interdental cleaning habit including flossing and interdental brushes was observed in only 66 (19.1%) patients. Two hundred and seventy-one patients (78.7%) needed scaling and root planing. Surgical treatment was performed in 16 patients (4.7%). Fifty-seven (16.6%) patients were accepted as periodontally stable. They needed no further treatment as they were having no progressive periodontal destruction and maintaining optimal clinical and radiographical parameters. Twenty-nine patients lost at least one tooth due to periodontal reason. Characteristics of the patients are presented in Table 5.

In Table 6, associations between patient characteristics and other factors are presented. Age, smoking, diabetes, no adherence to tooth brushing, and interdental cleaning can be correlated with tooth loss ($P < 0.05$). On the other hand, periodontal stability was associated with proper tooth brushing and interdental cleaning ($P < 0.05$).

Risk analyses showed that patients >55 years were more likely to have tooth loss (OR: 2.2 Lower: 1.596 Upper: 3.076). Tooth loss can occur more in smokers than non-smokers (OR: 3.1 Lower: 1.427 Upper: 6.709). Patients with diabetes (OR: 13.7 Lower: 5.010 Upper: 37.600) were more prone to have tooth loss (OR: 1.3 Lower: 1.390 Upper: 1.251). Tooth loss was observed in patients who had no adherence to tooth brushing (OR: 5 Lower: 1.976 Upper: 9.345) [Table 7].

DISCUSSION

Patients with various periodontal conditions apply to dental offices and universities seeking help for health.

However, periodontal tissues are already affected by the insidious disease when patients are aware of a problem such as bleeding, recession, and mobility of the teeth. So, the focus of periodontal treatment should not only be the removal of deposits but also to investigate the onset of the disease and the potential risk factors. The new classification not only emphasizes the severity and complexity of periodontal diseases but also gives us information about the risk of progression, presence of risk factors, and anticipated treatment response. In this study, out of the 454 private practice patients, 76.9% had periodontitis. Most of them had stage 3 grade C periodontitis (40.4%). This was in accordance with other studies designed at university settings.^[22,23]

Age is an important risk factor for periodontitis and tooth loss.^[24,25] In a recent systematic review by Helal *et al.*,^[11] the odds of tooth loss increased by 5% parallel with age. Similarly, in this study, periodontitis was significantly observed more with increasing age. Mean age for patients who lost at least one tooth during SPT was 52.34 ± 11.98 years, the risk of having tooth loss (OR) was 2.2 in patients >55 years. Tobacco use is also known to be one of the main reasons for tooth loss in middle age and patients >65 years.^[26] As we know from pioneer Preber and Bergström studies, over the years scientists empowered the health problems and its strong association between smoking (including smokeless tobacco) and periodontitis so as tooth loss.^[25,27] Among 349 periodontitis patients, 25.5% were smokers while the corresponding value was only 2.9% for gingivitis patients. Significant association was found between smoking and periodontitis. Tooth loss during SPT was also significantly associated with smoking. In order to minimize this ongoing risk factor for periodontitis, education of dentists on smoking cessation protocol is needed. Studies on dental students and dentists also showed that the knowledge, willingness, and ability of practitioners to provide information and improve motivation on smoking cessation to patients was found to increase by training including didactic lectures and seminars.^[28,29]

Uncontrolled diabetes is accepted as another risk factor for periodontitis and tooth loss.^[11,24,30] According to the new classification by Chapple *et al.*^[11] uncontrolled diabetes is also one of the determining factors for the diagnosis and progression rate. Risk of tooth loss during SPT was more (OR: 13.7) in diabetic patients as compared to nondiabetics. Conversely, no significant association was found between diabetes and periodontitis in this study. This discrepancy may be explained by very little amount of periodontitis patients having diabetes (5.7%). Thus, studies with larger groups do better indicate this relationship.

According to the definition in the consensus report of 2017 World Workshop,^[1] periodontal stability was observed in 16.6% of patients in this study. None of them had diabetes and only 11% were smoker. All had adherence to oral hygiene by brushing. Mean observation time was 24.10 ± 16.89 months. Periodontal stability was observed in middle aged and only within 2 years of observation time. Thus, short period is one limitation of this study. Together with increasing age and mean observation time not only periodontal stability was lost but also tooth loss was observed. Mean age of 29 patients who lost at least one tooth during maintenance was 52.34 ± 11.98 years. Mean observation time was 42.68 ± 15.11 months. However, among them 76% were initially at the advanced stage of periodontitis (stage 3 and 4) and progression rate was C (high risk of progression). These findings support the importance of patient education in maintaining good oral hygiene at earlier ages and positive effect of systemic condition for healthy periodontium. Periodontitis is an insidious disease so patients seeking for periodontal care apply to dental offices lately. As a result, tooth loss is inevitable. More studies with larger population and longer observation periods are needed to evaluate periodontal stability more accurately.

Out of the 344 patients who followed SPT, 16 (4.7%) needed surgical treatment. Even when they were under maintenance therapy, the need for retreatment may be explained by the improper oral hygiene habits together with changes in systemic condition over time. Fifty percent of them had diabetes and experienced tooth loss during a mean observation time of 47.37 ± 14.75 months. None of the patients brushed and performed interdental cleaning at the same time and only two patients had the habit of brushing alone. Mean age was 46.68 ± 12.54 years, twice as periodontally stable patients. According to the data collected at first visit, 69% had high progression rate (grade C). As the ratio of bone loss to age, presence of diabetes, and smoking are the determining factors for grading, findings of this study confirm the reliability of diagnosis about progression rate of periodontitis.

Among 454 patients, 110 (24.2%) were noncompliant. Twenty-nine (26.4%) of them were initially diagnosed as gingivitis and 81 (73.6%) as periodontitis. In a recent review by Echeverría *et al.*,^[31] approximately 30% of treated periodontitis patients followed maintenance therapy. Lack of information and motivation of patients can be considered as a reason for noncompliance. Clinicians should discuss with the patients in more detail about the onset and progression of periodontal diseases as well as potential tooth loss. As one of the limitations,

data presented here were based on only private practice patients. Studies combined with university and private practice with broader sample sizes may improve our knowledge about the prevalence of periodontal diseases and patient compliance. One examiner analyzed the whole data where bias may occur due to not having someone else for calibration. This may be considered as another limitation of this study.

Adherence to oral hygiene was evaluated by behaviors as observed by clinician and measures of compliance to oral hygiene instructions such as changes in tooth paste weight. However, as being another limitation of this study, changes in patient's attitudes, beliefs, pain, and quality of life or changes in clinical outcomes such as plaque and bleeding scores can also be evaluated for adherence to oral hygiene.^[21]

Tonetti and Sanz^[2] declared that data indicate that roughly one in ten adults (10%) suffer from "severe" (stage 3 or 4) periodontitis and that another 10% of the population is periodontally healthy, while 80% of the subjects suffer from either gingivitis or mild to moderate (Stage 1 or 2) periodontitis. However, Graetz *et al.*^[23] classified 93.6% of patients as stage 3 or 4 in a study published at the same year. The corresponding value for severe periodontitis was 47.6% in this study. The imbalances between results questions how useful the new classification is and whether it can be adapted for treatment planning. Thus, more studies with larger groups will reveal this conflict. Additionally, periodontal stability was observed in only 16.6% of patients who attended SPT regularly with a mean observation time of 2 years. Together with decrease in periodontal stability, tooth loss was also observed with prolonged observation time and irregular visits. This highlights the importance of patient education about periodontal diseases and compliance to maintenance.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Chapple ILC, Mealey BL, Van Dyke TE, Bartold PM, Dommisch H, Eickholz P, *et al.* Periodontal health and gingival

- diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 world workshop on the classification of periodontal and peri-implant diseases and conditions. *J Periodontol* 2018;89(Suppl 1):S74-84.
2. Tonetti MS, Sanz M. Implementation of the new classification of periodontal diseases: Decision-making algorithms for clinical practice and education. *J Clin Periodontol* 2019;46:398-405.
 3. Matuliene G, Pjetursson BE, Salvi GE, Schmidlin K, Brägger U, Zwahlen M, *et al.* Influence of residual pockets on progression of periodontitis and tooth loss: Results after 11 years of maintenance. *J Clin Periodontol* 2008;35:685-95.
 4. Armitage GC, Xenoudi P. Post-treatment supportive care for the natural dentition and dental implants. *Periodontol* 2000 2016;71164-84.
 5. Amerio E, Mainas G, Petrova D, Giner Tarrida L, Nart J, Monje A. Compliance with supportive periodontal/peri-implant therapy: A systematic review. *J Clin Periodontol* 2020;47:81-100.
 6. Fardal Ø, Johannessen AC, Linden GJ. Tooth loss during maintenance following periodontal treatment in a periodontal practice in Norway. *J Clin Periodontol* 2004;31:550-5.
 7. Chambrone LA, Chambrone L. Tooth loss in well-maintained patients with chronic periodontitis during long-term supportive therapy in Brazil. *J Clin Periodontol* 2006;33:759-64.
 8. Claffey N, Nylund K, Kiger R, Garrett S, Egelberg J. Diagnostic predictability of scores of plaque, bleeding, suppuration and probing depth for probing attachment loss: 31/2-years of observation following initial periodontal therapy. *J Clin Periodontol* 1990;17:108-14.
 9. Lang NP, Adler R, Joss A, Nyman S. Absence of bleeding on probing an indicator of periodontal stability. *J Clin Periodontol* 1990;17:714-21.
 10. Nazir MA. Prevalence of periodontal disease, its association with systemic diseases and prevention. *Int J Heal Sci* 2017;11:72-80.
 11. Helal O, Göstemeyer G, Krois J, Fawzy El Sayed K, Graetz C, Schwendicke F. Predictors for tooth loss in periodontitis patients: Systematic review and meta-analysis. *J Clin Periodontol* 2019;46:699-712.
 12. Johnson GK, Hill M. Cigarette smoking and the periodontal patient. *J Periodontol* 2004;75:196-209.
 13. Grossi SG, Zambon JJ, Ho AW, Koch G, Dunford RG, Machtei EE, *et al.* Assessment of risk for periodontal disease. I. Risk indicators for attachment loss. *J Periodontol* 1994;65:260-7.
 14. Patel MH, Kumar JV, Moss ME. Diabetes and tooth loss: An analysis of data from the national health and nutrition examination survey, 2003-2004. *J Am Dent Assoc* 2013;144:478-85.
 15. Grodstein F, Colditz GA, Stampfer MJ. Post-menopausal hormone use and tooth loss: A prospective study. *J Am Dent Assoc* 1996;127:370-7.
 16. Nocini R, Lippi G, Mattiuzzi C. Periodontal disease: The portrait of an epidemic. *J Public Heal Emerg* 2020;4. doi: 10.21037/jphe.2020.03.01.
 17. Michaud DS, Fu Z, Shi J, Chung M. Periodontal disease, tooth loss, and cancer risk. *Epidemiol Rev* 2017;39:49-58.
 18. Lertpimonchai A, Rattanasiri S, Arj-Ong Vallibhakara S, Attia J, Thakkestian A. The association between oral hygiene and periodontitis: A systematic review and meta-analysis. *Int Dent J* 2017;67:332-43.
 19. Morrison EC, Lang NP, Loe H, Ramfjord SP. Effects of repeated scaling and root planing and/or controlled oral hygiene on the periodontal attachment level and pocket depth in beagle dogs: I. Clinical findings. *J Periodontol Res* 1979;14:428-37.
 20. Caton JG, Armitage G, Berglundh T, Chapple ILC, Jepsen S, Kornman KS, *et al.* A new classification scheme for periodontal and peri-implant diseases and conditions – Introduction and key changes from the 1999 classification. *J Clin Periodontol* 2018;45(Suppl 20):S1-8.
 21. Newton JT, Asimakopoulou K. Managing oral hygiene as a risk factor for periodontal disease: A systematic review of psychological approaches to behaviour change for improved plaque control in periodontal management. *J Clin Periodontol* 2015;42(Suppl 16):S36-46.
 22. Ravidà A, Qazi M, Troiano G, Saleh MHA, Greenwell H, Kornman K. Using periodontal staging and grading system as a prognostic factor for future tooth loss: A long-term retrospective study. *J Periodontol* 2020;91:454-61.
 23. Graetz C, Mann L, Krois J, Sälzer S, Kahl M, Springer C, *et al.* Comparison of periodontitis patients' classification in the 2018 versus 1999 classification. *J Clin Periodontol* 2019;46:908-17.
 24. Delgado-Pérez V, De La Rosa-Santillana R, Márquez-Corona M, Ávila-Burgos L, Islas-Granillo H, Minaya-Sánchez M, *et al.* Diabetes or hypertension as risk indicators for missing teeth experience: An exploratory study in a sample of Mexican adults. *Niger J Clin Pract* 2017;20:1335-41.
 25. Nilsson H, Sanmartin Berglund J, Renvert S. Longitudinal evaluation of periodontitis and tooth loss among older adults. *J Clin Periodontol* 2019;46:1041-9.
 26. Desalu OO, Iseh KR, Olokoba AB, Salawu FK, Danburam A. Smokeless tobacco use in adult nigerian population. *Niger J Clin Pract* 2010;13:382-7.
 27. Akaji EA, Folaranmi N. Tobacco use and oral health of inmates in a nigerian prison. *Niger J Clin Pract* 2013;16:473-7.
 28. Uti OG, Sofola O. Impact of an educational intervention on smoking counseling practice among Nigerian dentists and dental students. *Niger J Clin Pract* 2015;18:75-9.
 29. Ehizele AO, Azodo CC, Ojehanon PI, Akhionbare O, Umoh AO, Adeghe HA. Prevalence of tobacco use among dental patients and their knowledge of its health effects. *Niger J Clin Pract* 2012;15:270-5.
 30. Demmer RT, Holtfreter B, Desvarieux M, Jacobs DR Jr, Kerner W, Nauck M, *et al.* The influence of type 1 and type 2 diabetes on periodontal disease progression: Prospective results from the study of health in pomerania (SHIP). *Diabetes Care* 2012;35:2036-42.
 31. Echeverría JJ, Echeverría A, Caffesse RG. Adherence to supportive periodontal treatment. *Periodontol* 2000 2019;79:200-9.