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Article

A New Artificial Intelligence (AI) Tool Used to Achieve a More Reliable and Precise Periodontal Risk Assessment, Diagnosis, and Prognosis (GF-PeDRA): A Pilot Study with 221 Patients

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Abstract: Objectives: The goal of this pilot study was to validate and introduce a new AI tool (algorithm), providing and comparing (1) the periodontal/peri-implant diagnosis between professional (specialist) and automated tool, (2) risk assessment and prognostication with the algorithm, and (3) establish cut-off limits for clinically significant disease with a new score system (GF-PeDRA score). **Methods:** All patients were evaluated by two evaluators, and in case of any divergence, the case was revisited and discussed until clarification and definition. The validation sample constituted 221 patients. The AI tool (GF-PeDRA©) had eighteen parameters to be assessed, involving systemic and local predictors, achieving an octadecagon (an eighteen-sided polygon). The parameters were: (1) The highest probing depth (PD); (2) Number of interproximal sites with bone loss; (3) The highest clinical attachment loss (CAL); (4) Maximum radiographic bone loss (RBL); (5) Bleeding on probing (% BoP); (6) Bone loss pattern; (7) Tooth loss including periodontally hopeless teeth planned for extraction; (8) Evidence of progression over five years; (9) Need for complex rehabilitation; (10) Patient's age; (11) CAL and biofilm accumulation; (12) Smoking; (13) Diabetes; (14) Extension and distribution of the disease; (15) Peri-implant disease; (16) Other systemic conditions (other than diabetes); (17) Furcation involvement; and (18) Necrotizing lesion. A new score system (GF-PeDRA© score) based on the percentual of the octadecagon area is obtained; if the area was $\geq 0\%$ to $\leq 9\%$, the prognosis is good; $\geq 10\%$ and $\leq 24\%$, it is fair; $\geq 25\%$ and $\leq 37\%$, poor; $\geq 38\%$ and $\leq 49\%$, it is questionable; and between $\geq 50\%$ to $\leq 100\%$, the prognosis is hopeless. **Results:** 221 patients were enrolled, with a mean age of 46.73. 5301 teeth were examined. 187 non-smokers (84.62%) and 34 smokers (15.38%) were included. 193 (87.33%) patients did not have diabetes, whereas 28 (12.67%) had. Comparing the diagnosis between both evaluators, $k=0.83$; all disagreed cases were re-discussed, and a final decision/diagnosis was reached. After this, the diagnosis found was contrasted with the diagnosis achieved by GF-PeDRA© and a perfect agreement was observed, 100% ($k=1.0$). 28 patients were diagnosed as periodontally healthy, 55 with plaque-induced gingivitis, and 138 with periodontitis. Only one case of molar/incisor pattern was observed. No peri-implant disease or necrotizing condition was found. The mean CAL found was 3.19 mm; 25 patients (11.31%) had a furcation involvement. The mean percentual of BoP found was 28.67% (median = 19%; maximum: 100%; minimum: 100%); and the mean PD was 5.31 mm. The mean of the new GF-PeDRA© score (ranging from 0% to 100%) was 28.64%, with a median of 32.2% (minimum: 0.6% and maximum: 64.1%). Then, analyzing the GF-PeDRA© score of 221 patients enrolled, 48 (21.73%) were sorted as a Good prognosis for periodontal treatment, 43 (19.45%) had a Fair prognosis, 43 (19.45%) had a Poor prognosis, 68 (30.77%) had a Questionable prognosis, and 19 (8.60%) had a Hopeless prognosis. **Conclusion:** The new AI tool (GF-PeDRA©) was validated and proved to be extremely helpful in diagnosing and providing risk assessment and prognosis.

Keywords: risk assessment; periodontics; periodontal assessment; prognosis; diagnosis; artificial intelligence; algorithm; periodontology

Introduction

The new classification system for periodontal and peri-implant diseases and conditions was introduced in 2018 following an International Workshop's deliberations and consensus reports [1]. It is the most evidence-based and clinically relevant system ever proposed. It is considered the first major update to the classification since 1999 [2]. The main areas of improvement were (1) facilitating an international language for clinical communication and population surveys of disease prevalence, (2) enabling proper diagnosis and prognostication for patient communication and education, (3) ensuring the implementation of appropriate treatment, and (4) enabling research into the etiology, pathogenesis, natural history, and treatment strategies. Since then, educational institutions and dentists began to utilize this new classification following the stipulated principles. It includes re-classification of disease modalities into novel schemes, including staging and grading for periodontitis, indicating the severity and extent of the disease, and considering the patient's overall health status [3]. As with all new system implementations, a learning curve is inevitably necessary through the experiences and correct interpretations of the guidelines.

Predictive, preventive, personalized, and participatory Periodontology ('5Ps') [4] represents the future of Periodontics. A predictive approach using high-tech tools for diagnosis permits a better detection of patients at risk and the early diagnosis of periodontitis/peri-implantitis when it is easier to treat successfully. It will be organized as a personalized prevention based on a single patient's genetic and microbiological status, and customized therapy will be tailored to the medical reality of the specific patient. Finally, the patient's active role will be emphasized through participatory collaboration.

Within the limitation of chair-side appointments, the risk assessment for periodontal/peri-implant treatments has become the most essential factor in determining predictability. Periodontal risk assessment is a systematic approach to evaluating an individual's likelihood of developing periodontal disease or experiencing its progression. This process is essential for identifying at-risk individuals and implementing preventive or therapeutic interventions tailored to their specific needs. Then, several periodontal risk assessment tools were already developed and validated [5,6]. Therefore, a systematic review [6] addressed five risk assessment tools. One of them, and the most used and accepted, is named the Periodontal Risk Assessment (PRA) [7]. It was presented as a valid system by studies, which indicated that patients could be identified at high risk for periodontal re-infection and progression after treatment by using only six criteria.

However, only six, or eight parameters, or a low number of factors analyzed to predict a periodontal risk assessment, facing all the advances in the periodontal/peri-implant classification, can be insufficient and transmit a "total" reality about the patient's periodontal/peri-implant condition. Then, there is a lack of inclusion of some parameters to be evaluated; e.g., non-chronic cases of periodontitis, necrotizing cases, other extreme complexities of information requested, which is often not simple to obtain, and the absence of possible risk factors (environmental exposures and genetic predispositions, e.g.) resulting in a non-complete assessment of the patient. Hence, such requirements can be essential for establishing an unbiased prognostication system.

Thus, the goal of this pilot study was to validate and introduce a new AI tool (algorithm), providing and comparing (1) the periodontal/peri-implant diagnosis between professional (specialist) and automated tool, (2) risk assessment and prognostication with the algorithm, and (3) establish cut-off limits for clinically significant disease with a new score system (GF-PeDRA score). Moreover, this tool will provide a practical and visible chart to help clinicians better demonstrate and explain the findings to the patients. This is the first time that a periodontal/peri-implant diagnosis and automated tool (GF - Periodontal Diagnosis and Risk Assessment [GF-PeDRA©]), evaluating 18 points, is reported in the literature, reporting a significant and visible spider chart with automatic updates, improving the understanding, the teachability, and comprehension of the patient's periodontal/peri-implant condition, observing the progression and potential risk factors.

Materials and Methods

This pilot study was approved by the local research ethical committee and was conducted in compliance with Good Clinical Practice and the Helsinki Declaration. Before inclusion, all patients signed the informed consent, permitting their inclusion. The recruitment period and study duration were from April 2022 to July 2023. All of them were evaluated by an expert/specialist in Periodontics (GVOF, 16 years of experience) and individually revised by a general dentist (JCHF, 14 years of clinical experience); in case of any divergence, the case was revisited and discussed until clarification and definition. The validation sample was constituted of 221 patients.

Eligibility Criteria

It included patients (≥ 18 years old) who were periodontally evaluated in the clinic of the university during the period of recruitment and assessment, without any restriction for systemic condition or language. It excluded any patient who demonstrated the desire to non-participate and refused to sign the informed consent.

GF-PeDRA© Presentation

As for other tolls, no single factor can be attributed to the development of periodontal/peri-implant diseases. The following eighteen parameters and the options, involving systemic and local predictors, have been identified by analyzing the current literature and included in this new toll, permitting the creation of an octadecagon (an eighteen-sided polygon) (Figure 1):

- 1. The highest probing depth (PD)** – the options found were: A. 0 - 3 mm; B. 4 mm; C. 5 mm; D. 6 mm; and > 6 mm;
- 2. Number of interproximal sites with bone loss** – the options available here were: A. 0; B. 1; C. 2; D. > 2 and < 8; E. ≥ 8 and < 12; and F. ≥ 12 ;
- 3. The highest clinical attachment loss (CAL)** – the options for this item were: A. 0; B. 1 - 2 mm; C. 3 - 4 mm; and D. > 4 mm;
- 4. Maximum radiographic bone loss (RBL)**, represented by the percentage (%) of bone loss – A. 0%; B. 5%; C. 10%; D. 12%; E. 14%; F. 15%; G. 21%; H. 28%; I. 34%; J. 40%; K. 46%; L. 51%; M. 56%; N. 61%; O. 66%; P. 71%; Q. 76%; R. 81%; S. 86%; T. 91%; and U. 100%;
- 5. Percentage of sites with bleeding on probing (BoP)** – A. 0-3%; B. 4-7%; C. 7-9%; D. $\geq 10\%$, E. $\leq 30\%$; and F. >30% up to 100%;
- 6. Bone loss pattern:** A. None; B. Horizontal bone loss; and C. Vertical bone loss;
- 7. Tooth loss including periodontally hopeless teeth planned for extraction:** A. No one; B. None due to periodontitis; C. Loss of up to 4 teeth due to periodontitis; and D. Loss of 5 or more teeth due to periodontitis;
- 8. Evidence of progression over 5 years** – A. No loss; B. < 2 mm; C. = 2; and D. > 2 mm;
- 9. Need for complex rehabilitation** – the options here were: A. No need; B. < 20 remaining teeth; C. Masticatory dysfunction; D. Bite collapse, drifting, or flaring; and E. Secondary occlusal trauma (mobility > II);
- 10. Patient's age**, which varied from 13 to 120 years old;
- 11. CAL and biofilm accumulation:** A. No CAL and no/low level of biofilm; B. Lower attachment loss in spite of heavy biofilm deposits; C. Attachment loss proportionate with biofilm levels; and D. Higher disproportionate attachment loss to biofilm levels;
- 12. Smoking:** A. Non-smoker; B. < 10 cigarettes/day; and C. ≥ 10 cigarettes/day;
- 13. Diabetes:** A. Non-diabetic (HbA1C up to 5.6%); B. HbA1C > 5.6% and < 7.0%; and C. HbA1C > 7.0%;
- 14. Extension and distribution of the disease:** A. Healthy periodontium; B. Localized (up to 30%); C. Generalized (> 30%); D. Molar-incisor (localized, $\leq 30\%$); and E. Molar-incisor (generalized, > 30%);
- 15. Peri-implant disease:** A. Without implant(s) or with healthy implant(s) in the mouth; B. Peri-implant mucositis up to 2 implants; C. Peri-implant mucositis in 3 implants or more; D. Peri-implantitis in 1 implant; E. Peri-implantitis in 2 implants; F. Peri-implantitis in 3 implants; and G. Peri-implantitis in 4 or more implants;

16. Other systemic conditions (other than diabetes): A. No; B. Yes. 1 or 2, but controlled; C. Yes. 3 or more, but controlled; D. Yes. 1 or 2, non-controlled; and E. Yes. 3 or more, non-controlled;
17. Furcation involvement: A. No; B. Class I furcation (< 3mm of horizontal attachment loss); C. Class II furcation (3mm or more of horizontal attachment loss); D. Class III furcation (Through & Through furcation involvement without direct clinical visualization); E. Class IV furcation (Through & Through furcation involvement with direct clinical visualization); and
18. Necrotizing lesion: A. No; B. Gingival necrosis, Gingival pain, Spontaneous bleeding, Ulceration of the gingival margin, and halitosis; C. Severe deep pain, Spontaneous bleeding, Halitosis, Gingival necrosis, Punched-out gingival papilla (inverted architecture), Loss of alveolar bone, Pseudomembrane formation, Lymph gland enlargement, Low-grade fever.

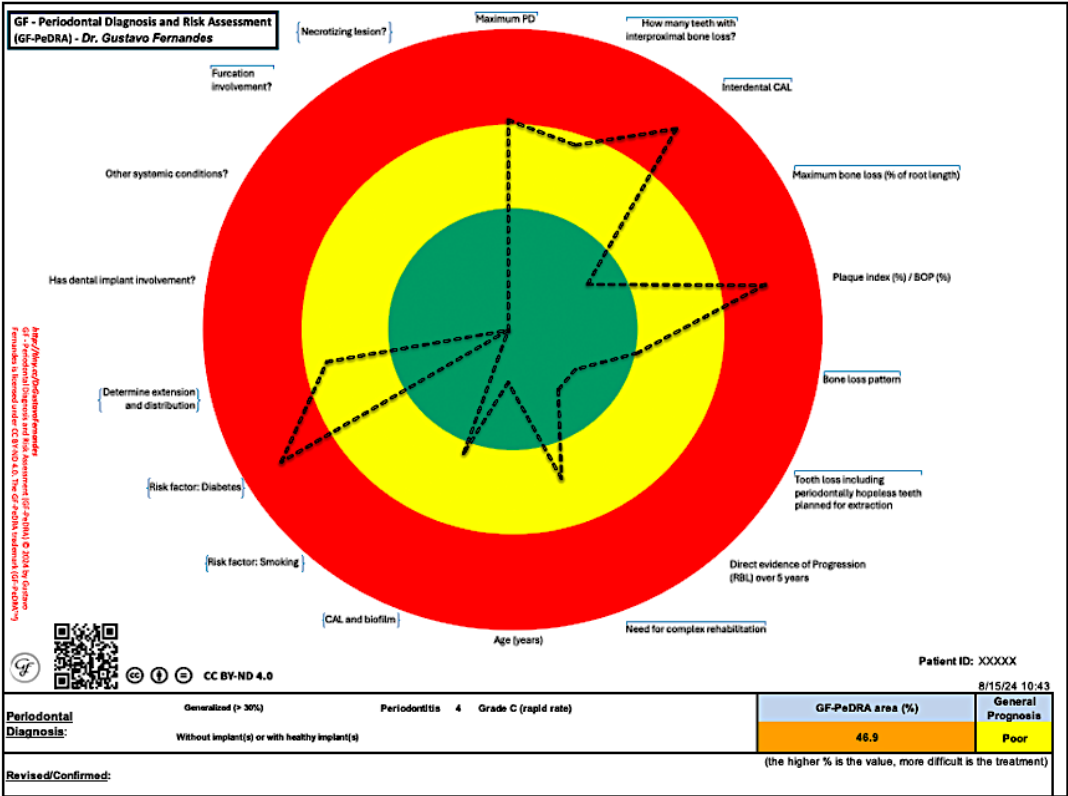


Figure 1. GF-PeDRA© tool for Diagnosis, Risk assessment with a new score system, and Prognosis.

Following the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases (Tonetti, Greenwell, & Kornman, 2018), these eighteen parameters have been combined in an octadecagon that permits to provide an automated diagnosis and visualizes the risk for disease development. Each vector/factor has its own scale for risk profiles, as detailed above. For some parameters, the response was dichotomic: yes or no; and for others, there was an increase in the level according to the presentation. A comprehensive evaluation using this functional diagram provided an individual total risk profile and prognosis for the periodontal treatment, with the presentation of a new score system, GF-PeDRA© score, based on the percentual (%) of the area obtained. If the area was found between, and including, $\geq 0\%$ to $\leq 9\%$, the prognosis is good; $\geq 10\%$ and $\leq 24\%$, it is fair; $\geq 25\%$ and $\leq 37\%$, poor; $\geq 38\%$ and $\leq 49\%$, it is questionable; and between $\geq 50\%$ to $\leq 100\%$, the prognosis is hopeless. According to the data inserted for each item, there is a new design presented in the octodecagon, suggesting then, a different GF-PeDRA score and prognosis.

Statistical Analysis

All descriptive analysis was performed. The comparison between professionals was evaluated, inter-reliability agreement, using the Cohen's kappa test as well as the ascertain of the results comparing professionals and the automated GF-PeDRA© tool.

RESULTS

Demographic Data

A total of 221 patients were enrolled (57.6% female and 42.4% male), with a mean age of 46.73 years (ranging from 18 to 93 years). 5301 teeth were examined. Sorting them by age, 18 individuals were ≥ 18 and ≤ 20 years old (y.o.); 35 were ≥ 21 and ≤ 30 y.o.; 37 were ≥ 41 and ≤ 50 y.o.; 34 were ≥ 51 and ≤ 60 y.o.; and 62 were > 60 y.o. 187 non-smokers (84.62%) were included and 34 smokers (15.38%); 21 of them smoked < 10 cigarettes/day and 13 smoked ≥ 10 cigarettes/day. 193 (87.33%) patients did not have diabetes, whereas 28 (12.67%) had (8 with HbA1C $\geq 7.0\%$ and 20 with HbA1c $> 5.6\%$ and $< 7.0\%$) (Table 1).

Clinical Data

28 patients were diagnosed as periodontally healthy, 55 with plaque-induced gingivitis, and 138 with periodontitis. Stratifying Periodontitis cases: 33 patients were diagnosed with Periodontitis I (A=10; B=19; and C=4); 18 had Periodontitis II (A=1; B=11; and C=6); 35 with Periodontitis III (A=3; B=20; and C=12); and 52 with Periodontitis IV (A=0; B=35; and C=17). Only one case of molar/incisor pattern was observed. No peri-implant disease or necrotizing condition was found.

The mean CAL found was 3.19 mm (maximum CAL: 14 mm; minimum CAL: zero); the mean of non-adjacent interdental surfaces with an interproximal bone loss was 6 (six) per patient. The bone loss pattern was in 135 cases horizontal (61.09%) and, in 3 cases, vertical (1.36%). 25 patients (11.31%) had a furcation involvement. The mean percentual of BoP found was 28.67% (median = 19%; maximum: 100%; minimum: 100%). The mean PD was 5.31 mm (median: 5 mm; maximum: 14 mm; minimum: 2 mm) (Table 1).

Table 1. Data collected from each patient with the necessary information – Part 1.

Patient	Age	Maximum PD (mm)	How many non-adjacent surfaces with interproximal bone loss?	Interdental CAL (mm)	Maximum RBL (% of root length) (bitewing)	Bone loss pattern	Tooth loss including periodontally hopeless teeth planned for extraction	Need for complex rehabilitation due to any of the following:	BOP (%)	Has peri-implant disease?	Direct evidence of Progression (RBL) over 5 years	CAL and biofilm
1	44	6	9	5	33	horizontal	None due to Periodontitis	No need	40	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
2	66	5	12	5	40	horizontal	None due to Periodontitis	< 20 remaining teeth; bite collapse	50	no	< 2 mm	Attachment loss proportionate with biofilm levels
3	79	5	5	7	50	horizontal	None due to Periodontitis	< 20 remaining teeth	0	no	= 2 mm	Attachment loss proportionate with biofilm levels
4	30	5	0	0	0	-	-	no need	40	no	-	No CAL and no/low level of biofilm
5	20	5	0	0	0	-	-	no need	100	no	-	No CAL and no/low level of biofilm

6	23	4	0	0	0	-	-	no need	13	no	-	No CAL and no/low level of biofilm
7	36	5	0	0	0	-	-	no need	85	no	-	No CAL and no/low level of biofilm
8	37	6	7	7	60	horizontal	Loss up to 4 teeth - periodontitis	bite colapse	60	no	> 2 mm	Attachment loss proportionate with biofilm levels
9	75	5	0	2	10	horizontal	-	no need	15	no	= 2 mm	Attachment loss proportionate with biofilm levels
10	61	4	0	0	0	-	None due to Periodontitis	no need	10	no	-	No CAL and no/low level of biofilm
11	58	6	7	8	90	horizontal	Loss of 5 or more teeth - periodontitis	Masticatory disfunction	23	no	> 2 mm	Attachment loss proportionate with biofilm levels
12	36	6	0	0	0	-	None due to Periodontitis	no need	70	no	-	No CAL and no/low level of biofilm
13	44	5	13	2	20	horizontal	None due to Periodontitis	no need	85	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
14	25	4	0	0	0	-	-	no need	85	no	-	No CAL and no/low level of biofilm
15	43	8	3	6	50	horizontal	No	no need	15	no	> 2 mm	Attachment loss proportionate with biofilm levels
16	57	5	6	5	30	horizontal	None due to Periodontitis	no need	8	no	= 2 mm	Attachment loss proportionate with biofilm levels
17	20	4	0	0	0	-	no one	no need	15	no	-	No CAL and no/low level of biofilm

18	18	4	0	0	0	-	no one	no need	10	no	-	No CAL and no/low level of biofilm
19	47	3	0	0	0	-	no one	no need	0	no	-	No CAL and no/low level of biofilm
20	70	7	3	6	40	horizontal	None due to Periodontitis	< 20 remaining teeth; masticatory dysfunction	90	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
21	78	6	8	8	40	horizontal	None due to Periodontitis	drifting	40	no	= 2 mm	Attachment loss proportionate with biofilm levels
22	58	5	0	0	0	-	no one	no need	20	no	-	No CAL and no/low level of biofilm
23	51	6	20	6	40	horizontal	no one	no need	20	no	= 2 mm	Attachment loss proportionate with biofilm levels
24	30	6	0	0	0	-	no one	no need	90	no	-	No CAL and no/low level of biofilm
25	60	7	7	7	50	horizontal	None due to Periodontitis	< 20 remaining teeth	15	no	= 2 mm	Attachment loss proportionate with biofilm levels
26	53	14	13	13	70	horizontal	Loss of 5 or more teeth - periodontitis	bite collapse	33	no	> 2 mm	Attachment loss proportionate with biofilm levels
27	31	4	0	0	0	-	no one	no need	15	no	-	No CAL and no/low level of biofilm

28	69	4	4	1	14	horizontal	None due to Periodontitis	no need	0	no	< 2 mm	Attachment loss proportionate with biofilm levels
29	52	5	0	0	0	-	no one	no need	15	no	-	No CAL and no/low level of biofilm
30	63	6	5	3	26	horizontal	None due to Periodontitis	no need	92	no	< 2 mm	Lower attachment loss in spite of heavy biofilm deposits
31	36	5	3	1.5	25	horizontal	no one	no need	14	no	= 2 mm	Attachment loss proportionate with biofilm levels
32	58	6	5	3	40	horizontal	no one	no need	6	no	< 2 mm	Attachment loss proportionate with biofilm levels
33	37	4	0	0	0	-	None due to Periodontitis	< 20 remaini ng teeth	5	no	-	No CAL and no/low level of biofilm
34	37	5	0	0	0	-	None due to Periodontitis	no need	10	no	-	No CAL and no/low level of biofilm
35	56	5	10	7	47	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth	25	no	= 2 mm	Attachment loss proportionate with biofilm levels
36	31	4	0	0	0	-	no	no need	40	no	-	No CAL and no/low level of biofilm
37	42	4	0	0	0	-	None due to Periodontitis	no need	45	no	-	No CAL and no/low level of biofilm
38	37	5	17	2	14	horizontal	None due to Periodontitis	no need	20	no	= 2 mm	Attachment loss proportionate with biofilm levels
39	18	4	0	0	0	-	no	no need	3	no	-	No CAL and no/low level of biofilm

40	60	11	11	12	70	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth; bite colapse	100	no	> 2 mm	Attachment loss proportionate with biofilm levels
41	62	4	0	0	0	-	no one	no need	6	no	-	No CAL and no/low level of biofilm
42	52	5	0	0	0	-	None due to Periodontitis	no need	5	no	-	No CAL and no/low level of biofilm
43	34	5	0	0	0	-	no	no need	40	no	-	No CAL and no/low level of biofilm
44	32	4	0	0	0	-	no	no need	8	no	-	No CAL and no/low level of biofilm
45	28	4	0	0	0	-	no	no need	33	no	-	No CAL and no/low level of biofilm
46	24	3	0	0	0	-	no	no need	5	no	-	No CAL and no/low level of biofilm
47	53	4	0	0	0	-	None due to Periodontitis	no need	33	no	-	No CAL and no/low level of biofilm
48	18	2	0	0	0	-	no	no need	25	no	-	No CAL and no/low level of biofilm
49	23	5	0	0	0	-	no	no need	11	no	-	No CAL and no/low level of biofilm
50	67	5	2	8	43.5	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth; masticat	0	no	> 2 mm	Attachment loss proportionate with biofilm levels

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51	30	4	0	0	0	-	no	no need	75	no	-	No CAL and no/low level of biofilm
52	47	5	4	4.5	45	horizontal	None due to Periodontitis	no need	70	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
53	71	5	13	5	45	horizontal	None due to Periodontitis	< 20 remaini ng teeth	50	no	= 2 mm	Attachment loss proportionate with biofilm levels
54	20	5	0	0	0	-	no	no need	15	no	-	No CAL and no/low level of biofilm
55	46	4	0	0	0	-	no	no need	0	no	-	No CAL and no/low level of biofilm
56	41	6	15	6	65	vertical	None due to Periodontitis	no need	14	no	> 2 mm	Higher disproportionate attachment loss to biofilm levels
57	25	4	0	0	0	-	no	no need	29	no	-	No CAL and no/low level of biofilm
58	57	5	17	6	65	horizontal	None due to Periodontitis	no need	6	no	> 2 mm	Attachment loss proportionate with biofilm levels
59	18	5	0	0	0	-	no	no need	35	no	-	No CAL and no/low level of biofilm
60	21	3	0	0	0	-	no	no need	43	no	-	No CAL and no/low level of biofilm
61	37	7	23	4	43	horizontal	None due to Periodontitis	no need	40	no	= 2 mm	Attachment loss proportionate with biofilm levels

62	50	6	8	6	41	horizontal	None due to Periodontitis	no need	17	no	= 2 mm	Attachment loss proportionate with biofilm levels
63	24	9	27	6	50	horizontal	no	no need	100	no	> 2 mm	Attachment loss proportionate with biofilm levels
64	18	5	0	0	0	-	no	no need	24	no	-	No CAL and no/low level of biofilm
65	21	4	0	0	0	-	no	no need	90	no	-	No CAL and no/low level of biofilm
66	45	6	2	2	14	horizontal	None due to Periodontitis	no need	80	no	= 2 mm	Attachment loss proportionate with biofilm levels
67	25	7	26	2	30	horizontal	no	no need	100	no	> 2 mm	Attachment loss proportionate with biofilm levels
68	24	3	0	0	0	-	None due to Periodontitis	< 20 remaini ng teeth	30	no	-	No CAL and no/low level of biofilm
69	34	5	7	1	1	horizontal	None due to Periodontitis	no need	35	no	< 2 mm	Attachment loss proportionate with biofilm levels
70	45	8	19	5	49	horizontal	no	no need	40	no	= 2 mm	Attachment loss proportionate with biofilm levels
71	40	7	25	4	40	horizontal	no	no need	100	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
72	52	11	8	8	80	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth	0	no	> 2 mm	Attachment loss proportionate with biofilm levels
73	45	8	19	5	49	horizontal	no	no need	40	no	< 2 mm	Attachment loss proportionate with biofilm levels

74	33	4	0	0	0	-	None due to Periodontitis	no need	17.6	no	-	No CAL and no/low level of biofilm
75	57	5	5	2	20	horizontal	None due to Periodontitis	< 20 remaining teeth	50	no	< 2 mm	Attachment loss proportionate with biofilm levels
76	47	5	5	4	20	horizontal	None due to Periodontitis	no need	30	no	= 2 mm	Attachment loss proportionate with biofilm levels
77	63	5	13	2	25	horizontal	no	no need	22	no	> 2 mm	Attachment loss proportionate with biofilm levels
78	65	5	12	6	50	horizontal	Loss of 5 or more teeth - periodontitis	Masticatory dysfunction	3	no	= 2 mm	Attachment loss proportionate with biofilm levels
79	18	4	0	0	0	-	no	no need	7	no	-	No CAL and no/low level of biofilm
80	36	4	0	0	0	-	None due to Periodontitis	< 20 remaining teeth	9.7	no	-	No CAL and no/low level of biofilm
81	40	4	9	5	25	horizontal	none due to Periodontitis	bite collapse	60	no	= 2 mm	Attachment loss proportionate with biofilm levels
82	33	6	18	6	40	horizontal	none due to Periodontitis	no need	37	no	= 2 mm	Attachment loss proportionate with biofilm levels
83	44	8	6	12	80	vertical	Loss up to 4 teeth - periodontitis	< 20 remaining teeth	21	no	> 2 mm	Attachment loss proportionate with biofilm levels

84	65	5	7	6	30	horizontal	none due to Periodontitis	< 20 remaini ng teeth	8	no	= 2 mm	Attachment loss proportionate with biofilm levels
85	63	6	13	4	8	horizontal	none due to Periodontitis	no need	40	no	< 2 mm	Attachment loss proportionate with biofilm levels
86	23	5	19	2	6	horizontal	no	no need	31	no	< 2 mm	Attachment loss proportionate with biofilm levels
87	70	6	13	3	10	horizontal	none due to Periodontitis	no need	15	no	= 2 mm	Attachment loss proportionate with biofilm levels
88	30	7	4	4	10	horizontal	none due to Periodontitis	no need	16	no	= 2 mm	Attachment loss proportionate with biofilm levels
89	42	7	14	7	15	horizontal	none due to Periodontitis	no need	39	no	= 2 mm	Attachment loss proportionate with biofilm levels
90	42	11	12	14	52	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse	100	no	> 2 mm	Attachment loss proportionate with biofilm levels
91	53	6	7	4	40	horizontal	none due to Periodontitis	drifting	60	no	= 2 mm	Attachment loss proportionate with biofilm levels
92	18	4	0	0	0	-	none due to Periodontitis	no need	32	no	-	No CAL and no/low level of biofilm
93	18	6	0	0	0	-	no	no need	90	no	-	No CAL and no/low level of biofilm
94	42	4	8	0.5	5	vertical	no	no need	15	no	< 2 mm	Attachment loss proportionate with biofilm levels

95	75	4	5	5	20	horizontal	none due to Periodontitis	no need	14	no	= 2 mm	Attachment loss proportionate with biofilm levels
96	34	4	0	0	0	-	none due to Periodontitis	no need	5	no	-	No CAL and no/low level of biofilm
97	36	5	7	1	10	horizontal	none due to Periodontitis	no need	15	no	= 2 mm	Attachment loss proportionate with biofilm levels
98	29	4	0	0	0	-	no	no need	19	no	-	No CAL and no/low level of biofilm
99	30	5	2	1	10	horizontal	none due to Periodontitis	no need	26	no	< 2 mm	Attachment loss proportionate with biofilm levels
100	21	4	0	0	0	-	no	no need	16	no	-	No CAL and no/low level of biofilm
101	58	7	5	6	50	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse	90	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
102	58	8	13	5	56	horizontal	none due to Periodontitis	no need	60	no	= 2 mm	Attachment loss proportionate with biofilm levels
103	72	4	5	1	10	horizontal	none due to Periodontitis	< 20 remaini ng teeth, Bite collapse	15	no	< 2 mm	Attachment loss proportionate with biofilm levels
104	40	8	18	9	43	horizontal	none due to Periodontitis	no need	20	no	> 2 mm	Attachment loss proportionate with biofilm levels

105	61	4	6	7	40	horizontal	none due to Periodontitis	< 20 remaini ng teeth, Bite collapse	23	no	= 2 mm	Attachment loss proportionate with biofilm levels
106	65	4	0	0	0	-	no	no need	2	no	-	No CAL and no/low level of biofilm
107	32	5	19	5	23	horizontal	none due to Periodontitis	no need	19	no	= 2 mm	Attachment loss proportionate with biofilm levels
108	88	4	0	6	30	horizontal	none due to Periodontitis	< 20 remaini ng teeth, Bite collapse	25	no	= 2 mm	Attachment loss proportionate with biofilm levels
109	78	7	7	6	60	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse	19	no	= 2 mm	Attachment loss proportionate with biofilm levels
110	62	7	21	5	43	horizontal	none due to Periodontitis	no need	40	no	= 2 mm	Attachment loss proportionate with biofilm levels
111	56	6	12	6	65	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse, masticat	17	no	= 2 mm	Attachment loss proportionate with biofilm levels

								ory disfuncti on				
112	38	5	0	0	0	-	none due to Periodontitis	drifting	7.1	no	-	No CAL and no/low level of biofilm
113	61	4	9	6	48	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, masticat ory disfuncti on	0	no	= 2 mm	Attachment loss proportionate with biofilm levels
114	48	6	18	3	20	horizontal	none due to Periodontitis	no need	39	no	< 2 mm	Attachment loss proportionate with biofilm levels
115	35	5	7	2	10	horizontal	none due to Periodontitis	no need	9	no	= 2 mm	Attachment loss proportionate with biofilm levels
116	28	6	0	0	0	-	none due to Periodontitis	no need	80	no	-	No CAL and no/low level of biofilm
117	39	4	0	0	0	-	none due to Periodontitis	no need	27	no	-	No CAL and no/low level of biofilm
118	66	5	2	6	50	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, masticat ory disfuncti on	30	no	= 2 mm	Attachment loss proportionate with biofilm levels

119	18	3	0	0	0	-	no	no need	29	no	-	No CAL and no/low level of biofilm
120	68	7	2	5	60	horizontal	Loss of 5 or more teeth - periodontitis	Secondary occlusal trauma (mobility II)	25	no	= 2 mm	Attachment loss proportionate with biofilm levels
121	65	7	18	5	45	horizontal	Loss of 5 or more teeth - periodontitis	masticatory dysfunction	1	no	= 2 mm	Attachment loss proportionate with biofilm levels
122	59	4	16	8	75	horizontal	none due to Periodontitis	no need	25	no	> 2 mm	Attachment loss proportionate with biofilm levels
123	73	6	14	5	76	horizontal	none due to Periodontitis	Bite collapse, Drifting, Flaring	3	no	= 2 mm	Attachment loss proportionate with biofilm levels
124	70	5	16	6	32	horizontal	Loss of 5 or more teeth - periodontitis	Bite collapse, Drifting, Flaring	30	no	< 2 mm	Attachment loss proportionate with biofilm levels
125	76	4	3	2	25	horizontal	none due to Periodontitis	< 20 remaining teeth, Bite collapse,	13	no	= 2 mm	Attachment loss proportionate with biofilm levels

								masticatory dysfunction				
126	29	5	0	0	0	-	none due to Periodontitis	no need	2	no	-	No CAL and no/low level of biofilm
127	31	5	0	0	0	-	no	no need	15	no	-	No CAL and no/low level of biofilm
128	28	7	6	4	40	horizontal	no	no need	100	no	= 2 mm	Attachment loss proportionate with biofilm levels
129	50	5	0	0	0	-	none due to Periodontitis	no need	7	no	-	No CAL and no/low level of biofilm
130	68	5	3	5	33	horizontal	Loss of up to 4 teeth - periodontitis	< 20 remaining teeth	15	no	= 2 mm	Attachment loss proportionate with biofilm levels
131	51	6	19	5	32.3	horizontal	none due to Periodontitis	no need	15	no	< 2 mm	Attachment loss proportionate with biofilm levels
132	41	5	5	2	20	horizontal	no	no need	34	no	= 2 mm	Attachment loss proportionate with biofilm levels
133	24	6	13	3	28	horizontal	none due to Periodontitis	no need	61	no	> 2 mm	Attachment loss proportionate with biofilm levels
134	62	3	0	0	0	-	none due to Periodontitis	< 20 remaining teeth	0	no	-	No CAL and no/low level of biofilm
135	47	5	22	7	28	horizontal	none due to Periodontitis	no need	24	no	= 2 mm	Attachment loss proportionate with biofilm levels

136	50	3	3	1	10	horizontal	none due to Periodontitis	< 20 remaini ng teeth	7	no	< 2 mm	Attachment loss proportionate with biofilm levels
137	72	6	18	10	37	horizontal	none due to Periodontitis	< 20 remaini ng teeth	1	no	= 2 mm	Attachment loss proportionate with biofilm levels
138	77	6	1	6	35	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse, masticat ory disfuncti on, Seconda ry occlusal trauma	2	no	= 2 mm	Attachment loss proportionate with biofilm levels
139	59	6	18	5	37	horizontal	none due to Periodontitis	no need	35	no	= 2 mm	Attachment loss proportionate with biofilm levels
140	18	4	0	0	0	-	no one	no need	0	no	-	No CAL and no/low level of biofilm
141	54	5	7	3	33	horizontal	none due to Periodontitis	no need	2	no	= 2 mm	Attachment loss proportionate with biofilm levels
142	64	4	12	6	40	horizontal	none due to Periodontitis	no need	21	no	= 2 mm	Attachment loss proportionate with biofilm levels

143	42	5	5	2	4	horizontal	none due to Periodontitis	< 20 remaini ng teeth	67	no	< 2 mm	Attachment loss proportionate with biofilm levels
144	75	6	12	11	46	horizontal	none due to Periodontitis	no need	88	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
145	64	5	4	1	24	horizontal	none due to Periodontitis	no need	83	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
146	28	6	0	0	0	-	no one	no need	18	no	-	No CAL and no/low level of biofilm
147	31	5	0	0	0	-	no one	no need	2	no	-	No CAL and no/low level of biofilm
148	29	7	16	4	32	horizontal	none due to Periodontitis	no need	7	no	> 2 mm	Attachment loss proportionate with biofilm levels
149	30	4	0	0	0	-	none due to Periodontitis	no need	28	no	-	No CAL and no/low level of biofilm
150	19	3	0	0	0	-	no one	no need	11	no	-	No CAL and no/low level of biofilm
151	39	6	5	2	14	horizontal	none due to Periodontitis	no need	8	no	= 2 mm	Attachment loss proportionate with biofilm levels
152	76	4	2	1	33	horizontal	none due to Periodontitis	no need	8	no	= 2 mm	Attachment loss proportionate with biofilm levels
153	45	5	0	0	0	-	none due to Periodontitis	no need	10	no	-	No CAL and no/low level of biofilm
154	56	4	7	1	10	horizontal	none due to Periodontitis	< 20 remaini ng teeth	29	no	< 2 mm	Attachment loss proportionate with biofilm levels

155	58	6	5	6	37	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaining teeth, Bite collapse, masticatory dysfunction	45	no	< 2 mm	Attachment loss proportionate with biofilm levels
156	34	4	0	0	0	-	no one	no need	13	no	-	No CAL and no/low level of biofilm
157	77	6	3	5	40	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaining teeth, Bite collapse	21	no	= 2 mm	Attachment loss proportionate with biofilm levels
158	71	4	4	6	43	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaining teeth	21	no	= 2 mm	Attachment loss proportionate with biofilm levels
159	64	7	5	4	38	horizontal	none due to Periodontitis	no need	6	no	= 2 mm	Attachment loss proportionate with biofilm levels
160	67	5	11	6	35	horizontal	none due to Periodontitis	< 20 remaining teeth	14	no	< 2 mm	Attachment loss proportionate with biofilm levels
161	71	5	11	7	40	horizontal	none due to Periodontitis	< 20 remaining teeth	23	no	= 2 mm	Attachment loss proportionate with biofilm levels

162	48	4	0	0	0	-	no one	no need	16	no	-	No CAL and no/low level of biofilm
163	29	4	0	0	0	-	none due to Periodontitis	no need	43	no	-	No CAL and no/low level of biofilm
164	26	6	0	0	0	-	no one	no need	31	no	-	No CAL and no/low level of biofilm
165	69	5	8	2	30	horizontal	none due to Periodontitis	no need	16	no	= 2 mm	Attachment loss proportionate with biofilm levels
166	32	4	0	0	0	-	none due to Periodontitis	no need	4	no	-	No CAL and no/low level of biofilm
167	30	5	0	0	0	-	none due to Periodontitis	no need	4	no	-	No CAL and no/low level of biofilm
168	74	7	8	7	70	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse, masticat ory disfuncti on	17	no	= 2 mm	Attachment loss proportionate with biofilm levels
169	32	5	-	6	-	horizontal	none due to Periodontitis	< 20 remaini ng teeth, Bite collapse, masticat	67	no	= 2 mm	Attachment loss proportionate with biofilm levels

								ory disfuncti on, Seconda ry occlusal trauma				
170	74	4	4	5	50	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, masticat ory disfuncti on	5	no	< 2 mm	Attachment loss proportionate with biofilm levels
171	60	7	7	10	63	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth	100	no	> 2 mm	Attachment loss proportionate with biofilm levels
172	32	4	6	2	23	horizontal	none due to Periodontitis	< 20 remaini ng teeth	52	no	< 2 mm	Attachment loss proportionate with biofilm levels
173	34	5	0	0	0	-	none due to Periodontitis	no need	41	no	-	No CAL and no/low level of biofilm
174	56	5	7	7	35	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth	19	no	= 2 mm	Attachment loss proportionate with biofilm levels
175	18	6	0	0	0	-	no one	no need	67	no	-	No CAL and no/low level of biofilm

176	52	5	2	5	20	horizontal	none due to Periodontitis	< 20 remaini ng teeth	8	no	= 2 mm	Attachment loss proportionate with biofilm levels
177	61	5	5	1	10	horizontal	none due to Periodontitis	no need	5	no	< 2 mm	Attachment loss proportionate with biofilm levels
178	54	7	23	7	15	horizontal	none due to Periodontitis	no need	43	no	= 2 mm	Attachment loss proportionate with biofilm levels
179	48	4	16	6	22	horizontal	none due to Periodontitis	no need	20	no	< 2 mm	Attachment loss proportionate with biofilm levels
180	45	6	6	6	33	horizontal	none due to Periodontitis	Bite colapse, Drifiting , Flaring	5	no	< 2 mm	Attachment loss proportionate with biofilm levels
181	46	4	0	0	0	-	no one	no need	15	no	-	No CAL and no/low level of biofilm
182	27	5	0	0	0	-	no one	no need	65	no	-	No CAL and no/low level of biofilm
183	48	5	0	0	0	-	no one	no need	3	no	-	No CAL and no/low level of biofilm
184	78	4	5	4	10	horizontal	none due to Periodontitis	no need	3	no	< 2 mm	Attachment loss proportionate with biofilm levels
185	21	5	0	0	0	-	no one	no need	19.7	no	-	No CAL and no/low level of biofilm
186	61	5	13	5	4	horizontal	none due to Periodontitis	no need	13	no	< 2 mm	Attachment loss proportionate with biofilm levels
187	93	7	10	8	17	horizontal	Loss of up to 4 teeth - periodontitis	no need	9.5	no	< 2 mm	Attachment loss proportionate with biofilm levels

188	33	5	0	0	0	-	no one	no need	3	no	-	No CAL and no/low level of biofilm
189	43	5	2	1	3	horizontal	none due to Periodontitis	no need	49	no	= 2 mm	Attachment loss proportionate with biofilm levels
190	62	4	0	0	0	-	none due to Periodontitis	< 20 remaining teeth	4	no	-	No CAL and no/low level of biofilm
191	43	6	3	6	10	horizontal	none due to Periodontitis	no need	66	no	= 2 mm	Attachment loss proportionate with biofilm levels
192	69	7	20	9	30	horizontal	none due to Periodontitis	no need	33	no	= 2 mm	Attachment loss proportionate with biofilm levels
193	25	4	0	0	0	-	no one	no need	8	no	-	No CAL and no/low level of biofilm
194	26	5	0	0	0	-	none due to Periodontitis	no need	52	no	-	No CAL and no/low level of biofilm
195	71	5	0	1	10	horizontal	none due to Periodontitis	masticatory dysfunction	0	no	< 2 mm	Attachment loss proportionate with biofilm levels
196	50	7	13	7	24	horizontal	none due to Periodontitis	no need	13	no	= 2 mm	Attachment loss proportionate with biofilm levels
197	18	4	0	0	0	-	no one	no need	0	no	-	No CAL and no/low level of biofilm
198	63	7	21	8	33	horizontal	none due to Periodontitis	no need	19	no	= 2 mm	Attachment loss proportionate with biofilm levels
199	46	6	14	8	54	horizontal	none due to Periodontitis	Bite collapse,	2	no	< 2 mm	Attachment loss proportionate with biofilm levels

								masticat ory disfuncti on				
200	49	6	14	5	10	horizontal	none due to Periodontitis	no need	2	no	> 2 mm	Attachment loss proportionate with biofilm levels
201	76	5	6	2	18	horizontal	none due to Periodontitis	Bite collapse, Drifiting , Flaring	4	no	< 2 mm	Attachment loss proportionate with biofilm levels
202	42	5	0	0	0	-	Loss of up to 4 teeth - periodontitis	Bite collapse, Drifiting , Flaring	1	no	-	No CAL and no/low level of biofilm
203	62	5	6	9	15	horizontal	none due to Periodontitis	< 20 remaini ng teeth, Bite collapse, masticat ory disfuncti on	93	no	= 2 mm	Lower attachment loss in spite of heavy biofilm deposits
204	63	6	16	8	31	horizontal	none due to Periodontitis	no need	79.5	no	> 2 mm	Attachment loss proportionate with biofilm levels
205	53	5	16	5	30	horizontal	no one	no need	59	no	= 2 mm	Attachment loss proportionate with biofilm levels

206	80	4	-	7	36	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaini ng teeth, Bite collapse, masticat ory disfuncti on	28	no	= 2 mm	Attachment loss proportionate with biofilm levels
207	25	5	0	0	0	-	no one	no need	27.6	no	-	No CAL and no/low level of biofilm
208	45	6	3	2	0	horizontal	none due to Periodontitis	no need	6	no	< 2 mm	Attachment loss proportionate with biofilm levels
209	34	6	4	3	27.6	horizontal	none due to Periodontitis	< 20 remaini ng teeth	53	no	= 2 mm	Attachment loss proportionate with biofilm levels
210	20	4	0	0	0	-	no one	no need	45	no	-	No CAL and no/low level of biofilm
211	44	6	0	0	0	-	none due to Periodontitis	< 20 remaini ng teeth	6	no	-	No CAL and no/low level of biofilm
212	29	5	0	0	0	-	no one	no need	7	no	-	No CAL and no/low level of biofilm
213	66	6	4	9	18	horizontal	Loss of 5 or more teeth - periodontitis	drifting	2.5	no	< 2 mm	Attachment loss proportionate with biofilm levels

214	65	8	13	6	23	horizontal	none due to Periodontitis	Bite collapse, drifting	9	no	= 2 mm	Attachment loss proportionate with biofilm levels
215	59	6	6	8	10	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaining teeth, Bite collapse, masticatory dysfunction	13	no	= 2 mm	Attachment loss proportionate with biofilm levels
216	18	5	0	0	0	-	no one	no need	26	no	-	No CAL and no/low level of biofilm
217	59	9	23	6	22	horizontal	none due to Periodontitis	no need	29	no	= 2 mm	Attachment loss proportionate with biofilm levels
218	66	5	2	1	6	horizontal	no one	no need	1	no	< 2 mm	Attachment loss proportionate with biofilm levels
219	58	4	3	1	8.4	horizontal	no one	no need	4	no	< 2 mm	Attachment loss proportionate with biofilm levels
220	65	6	9	11	70	horizontal	Loss of 5 or more teeth - periodontitis	< 20 remaining teeth, Bite collapse, masticatory	6	no	= 2 mm	Attachment loss proportionate with biofilm levels

								disfuncti on, Seconda ry occlusal trauma				
221	59	6	8	7	20	horizontal	Loss of up to 4 teeth - periodontitis	drifting	23	no	> 2 mm	Attachment loss proportionate with biofilm levels

Patients were Classified as B when it was the first appointment as well as = 2 mm for progression in RBL (no evidence of at least 5 years). Green background = Periodontal healthy; Yellow background = gingivitis; No background = Periodontitis.

Table 1. (continued). Data collected from each patient with the necessary information – Part 2.

Patient	Risk factor: Smoking	Risk factor: Diabetes	Has any other systemic condition (besides diabetes)?	Determine extension and distribution	Furcation ?	Necrotizing lesion	Number of remnant teeth
1	non-smoker	HbA1C ≥ 7.0%	no	generalized (> 30%)	no	no	9
2	smoke < 10	no	1-2, controlled	generalized (> 30%)	no	no	23
3	non-smoker	no	>2, controlled	localized (< 30%)	no	no	17
4	smoke > 10	no	no	localized (< 30%)	no	no	32
5	non-smoker	no	no	generalized (> 30%)	no	no	32
6	non-smoker	no	no	localized (< 30%)	no	no	28
7	non-smoker	no	no	generalized (> 30%)	no	no	32
8	non-smoker	no	no	generalized (> 30%)	no	no	21
9	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	25
10	non-smoker	no	>2, controlled	localized (< 30%)	no	no	26
11	non-smoker	no	no	generalized (> 30%)	Class I	no	20

12	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	32
13	smoke < 10	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	no	no	30
14	non-smoker	no	no	generalized (> 30%)	no	no	30
15	non-smoker	no	1-2, non-controlled	generalized (> 30%)	Class I	no	32
16	non-smoker	no	no	localized (< 30%)	no	no	24
17	non-smoker	no	no	localized (< 30%)	no	no	32
18	non-smoker	no	no	localized (< 30%)	no	no	28
19	smoke < 10	no	no	-	no	no	17
20	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	11
21	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	27
22	non-smoker	HbA1c > 5.6% and < 7.0%	no	localized (< 30%)	no	no	23
23	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	31
24	smoke < 10	no	1-2, controlled (pregnant)	generalized (> 30%)	no	no	28
25	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	17
26	smoke < 10	no	no	generalized (> 30%)	Class II	no	24
27	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	30
28	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	24
29	non-smoker	no	no	localized (< 30%)	no	no	30
30	non-smoker	no	>2, controlled	generalized (> 30%)	no	no	22
31	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	29
32	non-smoker	no	no	localized (< 30%)	no	no	29
33	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	21
34	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	30
35	non-smoker	no	no	generalized (> 30%)	no	no	17

36	non-smoker	no	no	generalized (> 30%)	no	no	31
37	non-smoker	no	no	generalized (> 30%)	no	no	26
38	smoke > 10	no	1-2, controlled	generalized (> 30%)	no	no	30
39	non-smoker	no	no	-	no	no	28
40	non-smoker	no	>2, controlled	generalized (> 30%)	Class III	no	15
41	non-smoker	no	1-2, controlled	-	no	no	27
42	smoke < 10	no	no	-	no	no	24
43	non-smoker	no	no	generalized (> 30%)	no	no	31
44	non-smoker	no	no	-	no	no	28
45	non-smoker	no	no	generalized (> 30%)	no	no	32
46	non-smoker	no	no	-	no	no	28
47	non-smoker	no	no	generalized (> 30%)	no	no	23
48	non-smoker	no	no	localized (< 30%)	no	no	26
49	non-smoker	no	no	localized (< 30%)	no	no	32
50	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	4
51	non-smoker	no	no	generalized (> 30%)	no	no	27
52	non-smoker	no	no	localized (< 30%)	no	no	26
53	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	19
54	non-smoker	no	no	localized (< 30%)	no	no	27
55	non-smoker	no	1-2, controlled	-	no	no	28
56	non-smoker	no	1-2, controlled	localized molar-incisor pattern	Class I	no	30
57	non-smoker	no	no	localized (< 30%)	no	no	32
58	non-smoker	no	1-2, controlled	generalized (> 30%)	Class II	no	28
59	non-smoker	no	no	generalized (> 30%)	no	no	32
60	non-smoker	no	no	generalized (> 30%)	no	no	28

61	non-smoker	no	no	generalized (> 30%)	no	no	27
62	non-smoker	no	no	localized (< 30%)	no	no	29
63	non-smoker	no	no	generalized (> 30%)	no	no	28
64	non-smoker	no	no	localized (< 30%)	no	no	28
65	non-smoker	no	no	generalized (> 30%)	no	no	32
66	non-smoker	no	>2, controlled	localized (< 30%)	no	no	29
67	non-smoker	no	no	generalized (> 30%)	no	no	30
68	non-smoker	no	no	localized (< 30%)	no	no	13
69	non-smoker	no	no	localized (< 30%)	no	no	26
70	smoke > 10	no	no	generalized (> 30%)	no	no	28
71	non-smoker	no	no	generalized (> 30%)	no	no	32
72	non-smoker	no	no	generalized (> 30%)	no	no	12
73	smoke > 10	no	no	generalized (> 30%)	no	no	28
74	non-smoker	no	no	localized (< 30%)	no	no	17
75	smoke < 10	no	1-2, controlled	generalized (> 30%)	no	no	15
76	smoke > 10	no	no	localized (< 30%)	Class II	no	25
77	non-smoker	HbA1C ≥ 7.0%	1-2, controlled	localized (< 30%)	no	no	29
78	non-smoker	HbA1c > 5.6% and < 7.0%	>2, controlled	generalized (> 30%)	no	no	23
79	non-smoker	no	no	localized (< 30%)	no	no	28
80	smoke > 10	no	no	localized (< 30%)	no	no	22
81	non-smoker	no	no	localized (< 30%)	no	no	24
82	smoke < 10	no	no	generalized (> 30%)	no	no	25
83	non-smoker	HbA1c > 5.6% and < 7.0%	no	localized (< 30%)	Class I	no	23
84	non-smoker	no	no	generalized (> 30%)	no	no	15

85	non-smoker	no	no	generalized (> 30%)	no	no	25
86	non-smoker	no	no	generalized (> 30%)	no	no	32
87	non-smoker	HbA1c > 5.6% and < 7.0%	>2, controlled	generalized (> 30%)	no	no	20
88	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	24
89	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	31
90	smoke > 10	no	1-2, non-controlled	generalized (> 30%)	Class I	no	16
91	non-smoker	no	no	localized (< 30%)	no	no	26
92	non-smoker	no	no	generalized (> 30%)	no	no	24
93	non-smoker	no	no	generalized (> 30%)	no	no	32
94	non-smoker	no	no	localized (< 30%)	no	no	28
95	non-smoker	no	no	localized (< 30%)	no	no	26
96	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	24
97	non-smoker	no	no	localized (< 30%)	no	no	29
98	non-smoker	no	no	localized (< 30%)	no	no	30
99	smoke < 10	no	1-2, non-controlled	localized (< 30%)	no	no	25
100	non-smoker	no	no	localized (< 30%)	no	no	28
101	non-smoker	HbA1c > 5.6% and < 7.0%	no	generalized (> 30%)	no	no	20
102	non-smoker	no	1-2, non-controlled	generalized (> 30%)	no	no	24
103	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	17
104	non-smoker	no	no	generalized (> 30%)	no	no	30
105	smoke < 10	no	1-2, controlled	generalized (> 30%)	no	no	9
106	non-smoker	no	no	localized (< 30%)	no	no	24
107	smoke < 10	no	no	generalized (> 30%)	no	no	23
108	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	4

109	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	19
110	non-smoker	no	no	generalized (> 30%)	no	no	27
111	smoke > 10	HbA1c > 5.6% and < 7.0%	>2, controlled	generalized (> 30%)	no	no	19
112	non-smoker	no	no	localized (< 30%)	no	no	28
113	smoke < 10	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	no	no	10
114	smoke < 10	no	no	generalized (> 30%)	no	no	26
115	non-smoker	no	1-2, non-controlled	generalized (> 30%)	no	no	27
116	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	30
117	non-smoker	no	no	localized (< 30%)	no	no	25
118	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	no	no	5
119	non-smoker	no	no	localized (< 30%)	no	no	28
120	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	24
121	non-smoker	no	>2, controlled	generalized (> 30%)	no	no	26
122	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	22
123	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	24
124	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	no	no	24
125	non-smoker	no	no	generalized (> 30%)	Class I	no	18
126	non-smoker	no	no	localized (< 30%)	no	no	31
127	non-smoker	no	no	localized (< 30%)	no	no	28
128	smoke > 10	no	1-2, controlled	generalized (> 30%)	no	no	28
129	non-smoker	no	1-2, controlled	-	no	no	29
130	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	24

131	smoke < 10	no	no	generalized (> 30%)	no	no	25
132	non-smoker	no	no	localized (< 30%)	no	no	29
133	non-smoker	no	no	generalized (> 30%)	no	no	27
134	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	-	no	no	12
135	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	27
136	non-smoker	no	no	localized (< 30%)	no	no	16
137	non-smoker	no	no	generalized (> 30%)	no	no	23
138	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	6
139	non-smoker	no	no	generalized (> 30%)	no	no	25
140	non-smoker	no	no	-	no	no	32
141	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	24
142	non-smoker	no	1-2, controlled	generalized (> 30%)	Class II	no	27
143	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	16
144	non-smoker	no	1-2, controlled	generalized (> 30%)	Class I	no	24
145	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	26
146	smoke < 10	no	no	localized (< 30%)	no	no	28
147	non-smoker	no	no	-	no	no	30
148	non-smoker	no	no	generalized (> 30%)	no	no	27
149	non-smoker	no	no	localized (< 30%)	no	no	22
150	non-smoker	no	no	localized (< 30%)	no	no	32
151	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	localized (< 30%)	no	no	27
152	non-smoker	no	no	localized (< 30%)	no	no	24
153	non-smoker	no	no	localized (< 30%)	no	no	24

154	non-smoker	HbA1c > 5.6% and < 7.0%	>2, controlled	generalized (> 30%)	no	no	22
155	smoke < 10	no	1-2, controlled	generalized (> 30%)	Class II	no	7
156	non-smoker	no	no	localized (< 30%)	no	no	32
157	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	no	no	7
158	non-smoker	no	no	generalized (> 30%)	no	no	16
159	non-smoker	HbA1C ≥ 7.0%	1-2, controlled	localized (< 30%)	no	no	27
160	non-smoker	HbA1C ≥ 7.0%	1-2, controlled	generalized (> 30%)	no	no	23
161	non-smoker	no	no	generalized (> 30%)	no	no	17
162	non-smoker	no	no	localized (< 30%)	no	no	31
163	non-smoker	no	no	generalized (> 30%)	no	no	28
164	non-smoker	no	no	generalized (> 30%)	no	no	30
165	non-smoker	HbA1C ≥ 7.0%	1-2, controlled	generalized (> 30%)	no	no	25
166	non-smoker	no	no	-	no	no	24
167	non-smoker	no	no	-	no	no	28
168	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	18
169	smoke > 10	no	no	generalized (> 30%)	no	no	5
170	smoke < 10	no	>2, non-controlled	generalized (> 30%)	no	no	14
171	non-smoker	HbA1C ≥ 7.0%	1-2, controlled	generalized (> 30%)	no	no	16
172	smoke < 10	no	no	generalized (> 30%)	no	no	14
173	non-smoker	HbA1c > 5.6% and < 7.0%	no	generalized (> 30%)	no	no	28
174	non-smoker	no	no	generalized (> 30%)	Class II	no	13
175	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	28
176	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	15

177	non-smoker	no	no	localized (< 30%)	no	no	25
178	non-smoker	no	1-2, controlled	generalized (> 30%)	Class III	no	25
179	smoke < 10	no	no	generalized (> 30%)	no	no	26
180	smoke < 10	no	no	localized (< 30%)	Class II	no	23
181	non-smoker	no	no	localized (< 30%)	Class I	no	28
182	non-smoker	no	no	generalized (> 30%)	no	no	30
183	non-smoker	no	1-2, controlled	-	no	no	28
184	non-smoker	HbA1c > 5.6% and < 7.0%	>2, controlled	generalized (> 30%)	no	no	23
185	non-smoker	no	no	localized (< 30%)	no	no	32
186	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	25
187	non-smoker	no	>2, controlled	generalized (> 30%)	no	no	23
188	non-smoker	no	no	-	no	no	28
189	non-smoker	no	no	localized (< 30%)	no	no	24
190	non-smoker	no	>2, controlled	localized (< 30%)	no	no	12
191	non-smoker	no	no	generalized (> 30%)	no	no	27
192	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	26
193	non-smoker	no	no	-	no	no	24
194	non-smoker	no	no	generalized (> 30%)	no	no	28
195	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	20
196	non-smoker	no	no	generalized (> 30%)	Class I	no	20
197	non-smoker	no	no	localized (< 30%)	no	no	34
198	non-smoker	no	no	generalized (> 30%)	Class I	no	25
199	smoke < 10	no	no	generalized (> 30%)	no	no	21
200	smoke > 10	no	1-2, controlled	generalized (> 30%)	Class II	no	22

201	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	localized (< 30%)	no	no	24
202	non-smoker	no	no	-	no	no	27
203	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	12
204	smoke > 10	no	1-2, controlled	generalized (> 30%)	Class I	no	22
205	non-smoker	no	no	generalized (> 30%)	no	no	25
206	non-smoker	no	1-2, controlled	generalized (> 30%)	no	no	3
207	non-smoker	no	no	localized (< 30%)	no	no	32
208	non-smoker	HbA1c > 5.6% and < 7.0%	>2, controlled	localized (< 30%)	no	no	23
209	non-smoker	no	no	generalized (> 30%)	no	no	16
210	non-smoker	no	no	generalized (> 30%)	no	no	31
211	non-smoker	no	no	-	no	no	21
212	non-smoker	no	1-2, controlled	-	no	no	32
213	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	Class I	no	20
214	non-smoker	no	1-2, controlled	generalized (> 30%)	Class I	no	23
215	smoke > 10	no	1-2, controlled	generalized (> 30%)	no	no	9
216	non-smoker	no	no	localized (< 30%)	no	no	32
217	non-smoker	HbA1C ≥ 7.0%	1-2, controlled	generalized (> 30%)	Class II	no	30
218	non-smoker	no	1-2, controlled	localized (< 30%)	no	no	28
219	non-smoker	no	no	localized (< 30%)	no	no	28
220	non-smoker	HbA1c > 5.6% and < 7.0%	1-2, controlled	generalized (> 30%)	no	no	15
221	non-smoker	HbA1C ≥ 7.0%	>2, controlled	generalized (> 30%)	Class I	no	25

Patients were Classified as B when it was the first appointment as well as = 2 mm for progression in RBL (no evidence of at least 5 years). Green background = Periodontal healthy; Yellow background = gingivitis; No background = Periodontitis.

GF-PeDRA© Score and Inter-Agreement Level

Comparing the diagnosis individually achieved by the evaluators, there was a good level of agreement ($k=0.83$). Therefore, 37 out of 221 patients were revised (Table 2, red letters), and the cases were discussed to a tie-break and to give the final clinical periodontal diagnosis. Then, all patients received a final periodontal diagnosis. Afterward, all information was inserted into the AI tool (GF-PeDRA©), and the diagnosis for each patient was automatically obtained; this AI diagnosis (GF-PeDRA©) was compared to the final clinical periodontal diagnosis found, resulting in a perfect agreement level (100%, $k=1.0$) (Table 2).

Furthermore, the new GF-PeDRA© score was achieved for each patient (possible range from 0% to 100%). The mean GF-PeDRA© score was 28.64%, with a median of 32.2% (minimum: 0.6% and maximum: 64.1%). Then, analyzing the GF-PeDRA© score of 221 patients enrolled, 48 (21.73%) were sorted as a Good prognosis for periodontal treatment, 43 (19.45%) had a Fair prognosis, 43 (19.45%) had a Poor prognosis, 68 (30.77%) had a Questionable prognosis, and 19 (8.60%) had a Hopeless prognosis. Table 2 presents details of the results per patient.

Table 2. Diagnosis reported by evaluators and found in the GF-PeDRA© tool; and GF-PeDRA© score for prognosis.

Patient number	Diagnosis (GVOF)	Final Diagnosis			GF-PeDRA	
		Diagnosis (JCHF)	(after discussion)	Diagnosis (GF-PeDRA©)	score (0-100%)	Prognosis
1	Periodontitis III-C	Periodontitis IV-C	Periodontitis III-C	Periodontitis III-C	41.4	Questionable
2	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	47.9	Questionable
3	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	41	Questionable
4	gingivitis	gingivitis	gingivitis	gingivitis	16.8	Fair
5	gingivitis	gingivitis	gingivitis	gingivitis	15.4	Fair
6	gingivitis	Healthy periodontium	gingivitis	gingivitis	9.4	Good
7	gingivitis	gingivitis	gingivitis	gingivitis	15.4	Fair
8	Periodontitis III-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	48.8	Questionable
9	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	25.4	Poor
10	gingivitis	gingivitis	gingivitis	gingivitis	12.7	Fair
11	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	51.5	Hopeless
12	gingivitis	gingivitis	gingivitis	gingivitis	17.4	Fair
13	Periodontitis I-B	Periodontitis II-B	Periodontitis I-B	Periodontitis I-B	36.7	Poor
14	gingivitis	gingivitis	gingivitis	gingivitis	11.2	Fair
15	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	39.8	Questionable

16	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	32.4	Poor
17	gingivitis	gingivitis	gingivitis	gingivitis	7.4	Good
18	gingivitis	gingivitis	gingivitis	gingivitis	7.4	Good
19	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	1.7	Good
20	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	46.6	Questionable
21	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	48.2	Questionable
22	gingivitis	gingivitis	gingivitis	gingivitis	11.4	Fair
23	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	40.2	Questionable
24	gingivitis	gingivitis	gingivitis	gingivitis	17.1	Fair
25	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	44.8	Questionable
26	Periodontitis IV-C	Periodontitis IV- C	Periodontitis IV-C	Periodontitis IV- C	59.8	Hopeless
27	gingivitis	gingivitis	gingivitis	gingivitis	7.4	Good
28	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	24.4	Fair
29	gingivitis	gingivitis	gingivitis	gingivitis	9.7	Good
30	Periodontitis II-B	Periodontitis II-B	Periodontitis II- B	Periodontitis II-B	39.1	Questionable
31	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	27.1	Poor
32	Periodontitis II-B	Periodontitis II-B	Periodontitis II- B	Periodontitis II-B	26.8	Poor
33	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	7.4	Good
34	gingivitis	gingivitis	gingivitis	gingivitis	11.7	Fair
35	Periodontitis III-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	45.7	Questionable
36	gingivitis	gingivitis	gingivitis	gingivitis	11.2	Fair
37	gingivitis	gingivitis	gingivitis	gingivitis	13.2	Fair
38	Periodontitis I-C	Periodontitis I-C	Periodontitis I- C	Periodontitis I-C	37.7	Poor
39	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	2.9	Good
40	Periodontitis IV-C	Periodontitis IV- C	Periodontitis IV-C	Periodontitis IV- C	64.1	Hopeless

41	Healthy periodontium	gingivitis	Healthy periodontium	Healthy periodontium	1.5	Good
42	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	7.4	Good
43	gingivitis	gingivitis	gingivitis	gingivitis	13.5	Fair
44	Healthy periodontium	gingivitis	Healthy periodontium	Healthy periodontium	3.2	Good
45	gingivitis	gingivitis	gingivitis	gingivitis	11.2	Fair
46	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	0.6	Good
47	gingivitis	gingivitis	gingivitis	gingivitis	13.2	Fair
48	gingivitis	gingivitis	gingivitis	gingivitis	6.4	Good
49	gingivitis	gingivitis	gingivitis	gingivitis	9.7	Good
50	Periodontitis IV-B	Periodontitis IV- C	Periodontitis IV-C	Periodontitis IV- C	43.4	Questionable
51	gingivitis	gingivitis	gingivitis	gingivitis	11.2	Fair
52	Periodontitis II-B	Periodontitis III-B	Periodontitis II- B	Periodontitis II-B	32.1	Poor
53	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	45.6	Questionable
54	gingivitis	Healthy periodontium	gingivitis	gingivitis	9.7	Good
55	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	1.0	Good
56	molar/incisor Periodontitis III-C	molar/incisor Periodontitis III- C	molar/incisor Periodontitis III-C	molar/incisor Periodontitis III- C	52.6	Hopeless
57	gingivitis	gingivitis	gingivitis	gingivitis	7.4	Good
58	Periodontitis III-C	Periodontitis IV- C	Periodontitis III-C	Periodontitis III- C	40.2	Questionable
59	gingivitis	gingivitis	gingivitis	gingivitis	13.5	Fair
60	gingivitis	gingivitis	gingivitis	gingivitis	10.2	Fair
61	Periodontitis II-C	Periodontitis II-C	Periodontitis II- C	Periodontitis II-C	41.3	Questionable
62	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	36.2	Poor
63	Periodontitis III-C	Periodontitis III- C	Periodontitis III-C	Periodontitis III- C	41.6	Questionable
64	gingivitis	gingivitis	gingivitis	gingivitis	9.7	Good
65	gingivitis	gingivitis	gingivitis	gingivitis	11.2	Fair

66	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	31.2	Poor
67	Periodontitis I-C	Periodontitis I-B	Periodontitis I-C	Periodontitis I-C	36.1	Poor
68	gingivitis	gingivitis	gingivitis	gingivitis	12.3	Fair
69	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	31.5	Poor
70	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	45	Questionable
71	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	39	Questionable
72	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	46.8	Questionable
73	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	45	Questionable
74	gingivitis	gingivitis	gingivitis	gingivitis	9.4	Good
75	Periodontitis I-B	Periodontitis IV-B	Periodontitis I-B	Periodontitis I-B	38.5	Questionable
76	Periodontitis II-C	Periodontitis II-C	Periodontitis II-C	Periodontitis II-C	35.2	Poor
77	Periodontitis I-C	Periodontitis I-C	Periodontitis I-C	Periodontitis I-C	34.1	Poor
78	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	49.6	Questionable
79	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	3.5	Good
80	Healthy periodontium	gingivitis	Healthy periodontium	Healthy periodontium	12.4	Fair
81	Periodontitis IV-C	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	39	Questionable
82	Periodontitis III-B	Periodontitis IV-B	Periodontitis III-B	Periodontitis III-B	43.3	Questionable
83	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	55.5	Hopeless
84	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	41	Questionable
85	Periodontitis II-A	Periodontitis II-A	Periodontitis II-A	Periodontitis II-A	42.3	Questionable
86	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	35.9	Poor

87	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	41.5	Questionable
88	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	33.5	Poor
89	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	40.6	Questionable
90	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	63.3	Hopeless
91	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	40.3	Questionable
92	gingivitis	gingivitis	gingivitis	gingivitis	17.4	Fair
93	gingivitis	gingivitis	gingivitis	gingivitis	15.4	Fair
94	Periodontitis I-A	Periodontitis II-A	Periodontitis I-A	Periodontitis I-A	26.8	Poor
95	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	29.4	Poor
96	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	3.5	Good
97	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	26.3	Poor
98	gingivitis	gingivitis	gingivitis	gingivitis	7.4	Good
99	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	27.7	Poor
100	gingivitis	Healthy periodontium	gingivitis	gingivitis	7.4	Good
101	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	53.1	Hopeless
102	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	48.4	Questionable
103	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	32.2	Poor
104	Periodontitis III-C	Periodontitis IV-C	Periodontitis III-C	Periodontitis III-C	42.2	Questionable
105	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	42.9	Questionable
106	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	2.9	Good
107	Periodontitis III-B	Periodontitis IV-B	Periodontitis III-B	Periodontitis III-B	39.3	Questionable
108	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	37.3	Poor

109	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	52.6	Hopeless
110	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	43.3	Questionable
111	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	58.2	Hopeless
112	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	5.8	Good
113	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	46.3	Questionable
114	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	37.6	Poor
115	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	30	Poor
116	gingivitis	gingivitis	gingivitis	gingivitis	17.4	Fair
117	gingivitis	gingivitis	gingivitis	gingivitis	9.4	Good
118	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	47.1	Questionable
119	gingivitis	gingivitis	gingivitis	gingivitis	8.4	Good
120	Periodontitis IV-B	Periodontitis III-B	Periodontitis IV-B	Periodontitis IV-B	50	Hopeless
121	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	50.8	Hopeless
122	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	Periodontitis III-C	40.2	Questionable
123	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	46.6	Questionable
124	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	52.7	Hopeless
125	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	30.2	Poor
126	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	5.2	Good
127	gingivitis	Healthy periodontium	gingivitis	gingivitis	9.7	Good
128	Periodontitis II-C	Periodontitis II-C	Periodontitis II-C	Periodontitis II-C	40.8	Questionable
129	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	5.8	Good
130	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	43.2	Questionable

131	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	41.9	Questionable
132	Periodontitis II-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	26.6	Poor
133	Periodontitis II-C	Periodontitis II-C	Periodontitis II- C	Periodontitis II-C	39	Questionable
134	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	7.5	Good
135	Periodontitis III-B	Periodontitis IV- B	Periodontitis III-B	Periodontitis III-B	39.6	Questionable
136	Periodontitis I-A	Periodontitis I-A	Periodontitis I- A	Periodontitis I-A	23.1	Fair
137	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	40	Questionable
138	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	37.3	Poor
139	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	41.6	Questionable
140	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	1	Good
141	Periodontitis II-B	Periodontitis II-B	Periodontitis II- B	Periodontitis II-B	24.9	Fair
142	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	34.8	Poor
143	Periodontitis I-A	Periodontitis II-A	Periodontitis I- A	Periodontitis I-A	30.1	Poor
144	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	39.2	Questionable
145	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	24.9	Fair
146	gingivitis	gingivitis	gingivitis	gingivitis	13.3	Fair
147	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	3.3	Good
148	Periodontitis II-C	Periodontitis II-C	Periodontitis II- C	Periodontitis II-C	35.7	Poor
149	gingivitis	gingivitis	gingivitis	gingivitis	9.4	Good
150	gingivitis	gingivitis	gingivitis	gingivitis	6.4	Good
151	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	29.8	Poor
152	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	21.6	Fair

153	gingivitis	gingivitis	gingivitis	gingivitis	9.7	Good
154	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	35.6	Poor
155	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	55	Hopeless
156	gingivitis	Healthy periodontium	gingivitis	gingivitis	7.4	Good
157	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	51.7	Hopeless
158	Periodontitis IV-B	Periodontitis III-B	Periodontitis IV-B	Periodontitis IV-B	41.8	Questionable
159	Periodontitis II-C	Periodontitis II-C	Periodontitis II-C	Periodontitis II-C	35.1	Poor
160	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	45.5	Questionable
161	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	40.9	Questionable
162	gingivitis	gingivitis	gingivitis	gingivitis	7.4	Good
163	gingivitis	gingivitis	gingivitis	gingivitis	13.2	Fair
164	gingivitis	gingivitis	gingivitis	gingivitis	14.3	Fair
165	Periodontitis I-C	Periodontitis I-C	Periodontitis I-C	Periodontitis I-C	37.1	Poor
166	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	3.5	Good
167	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	5.2	Good
168	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	54.9	Hopeless
169	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	40.4	Questionable
170	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	44.6	Questionable
171	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	Periodontitis IV-C	54.5	Hopeless
172	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	34.5	Poor
173	gingivitis	gingivitis	gingivitis	gingivitis	17.1	Fair
174	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	47.3	Questionable
175	gingivitis	gingivitis	gingivitis	gingivitis	17.1	Fair

176	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	35.7	Poor
177	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	22.4	Fair
178	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	47	Questionable
179	Periodontitis III-B	Periodontitis IV-B	Periodontitis III-B	Periodontitis III-B	37	Poor
180	Periodontitis IV-C	Periodontitis IV-B	Periodontitis IV-B	Periodontitis IV-B	44.1	Questionable
181	gingivitis	Healthy periodontium	gingivitis	gingivitis	10	Fair
182	gingivitis	gingivitis	gingivitis	gingivitis	15.1	Fair
183	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	4.9	Good
184	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	Periodontitis II-B	29.5	Poor
185			gingivitis	gingivitis	9.7	Good
186	Periodontitis III-A	Periodontitis III-A	Periodontitis III-A	Periodontitis III-A	38	Questionable
187	Periodontitis III-A	Periodontitis III-A	Periodontitis III-A	Periodontitis III-A	42.6	Questionable
188	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	3.3	Good
189	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	Periodontitis I-B	31.8	Poor
190	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	10.7	Fair
191	Periodontitis III-B	Periodontitis III-A	Periodontitis III-A	Periodontitis III-A	36.3	Poor
192	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	44	Questionable
193	Healthy periodontium	gingivitis	Healthy periodontium	Healthy periodontium	3.5	Good
194	gingivitis	gingivitis	gingivitis	gingivitis	22	Fair
195	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	Periodontitis I-A	25.5	Poor
196	Periodontitis III-B	Periodontitis IV-B	Periodontitis III-B	Periodontitis III-B	41.7	Questionable
197	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	7.5	Good

198	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	42.4	Questionable
199	Periodontitis IV-C	Periodontitis IV- C	Periodontitis IV-C	Periodontitis IV- C	45.3	Questionable
200	Periodontitis III-C	Periodontitis III- C	Periodontitis III-C	Periodontitis III- C	41.2	Questionable
201	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	33.4	Poor
202	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	14.3	Fair
203	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	43.3	Questionable
204	Periodontitis III-C	Periodontitis III- C	Periodontitis III-C	Periodontitis III- C	47.2	Questionable
205	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	Periodontitis III-B	37.1	Poor
206	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	42.2	Questionable
207	gingivitis	gingivitis	gingivitis	gingivitis	9.7	Good
208	Periodontitis I-B	Periodontitis I-B	Periodontitis I- B	Periodontitis I-B	28.9	Poor
209	Periodontitis II-B	Periodontitis IV- B	Periodontitis II- B	Periodontitis II-B	39.7	Questionable
210	gingivitis	gingivitis	gingivitis	gingivitis	11.2	Fair
211	Healthy periodontium	Healthy periodontium	Healthy periodontium	Healthy periodontium	11.6	Fair
212	Healthy periodontium	gingivitis	Healthy periodontium	Healthy periodontium	5.5	Good
213	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	47.1	Questionable
214	Periodontitis IV-B	Periodontitis IV- B	Periodontitis IV-B	Periodontitis IV-B	47.7	Questionable
215	Periodontitis IV-C	Periodontitis IV- C	Periodontitis IV-C	Periodontitis IV- C	51.3	Hopeless
216	gingivitis	gingivitis	gingivitis	gingivitis	9.7	Good
217	Periodontitis III-C	Periodontitis III- C	Periodontitis III-C	Periodontitis III- C	48	Questionable
218	Periodontitis I-A	Periodontitis II-A	Periodontitis I- A	Periodontitis I-A	19.4	Fair
219	Periodontitis I-A	Periodontitis I-A	Periodontitis I- A	Periodontitis I-A	18.2	Fair

220	Periodontitis IV-C	Periodontitis IV- C	Periodontitis IV-C	Periodontitis IV- C	51.4	Hopeless
221	Periodontitis IV-C	Periodontitis III- C	Periodontitis IV-C	Periodontitis IV- C	50.7	Hopeless

Discussion

The concept of periodontal risk assessment was introduced as a systematic approach to evaluating a patient's risk of developing periodontal disease. It is worth remembering that periodontal disease is a prevalent condition that affects millions of people worldwide, posing significant risks to oral and systemic health. Thereby, accurate risk assessment is critical for the effective management and prevention of periodontal disease, guiding clinicians in tailoring preventive and therapeutic strategies to individual patients. Over the years, various tools have been developed and modified to enhance their predictive accuracy and clinical utility. But, observing many shortcomings, this article aimed to introduce, test, and validate a new AI tool for periodontal diagnosis, risk assessment, and prognosis of periodontal treatments (GF-PeDRA©).

To verify it, an algorithm was used in 221 patients, obtaining a complete inter-agreement rate (100%) with the final diagnosis provided by the evaluators. Moreover, this tool provided a practical and visible chart, one specific for professionals and another one for patients, to better demonstrate and explain the findings. This is the first time in the literature that a periodontal/peri-implant diagnosis and automated tool (GF - Periodontal Diagnosis and Risk Assessment [GF-PeDRA©]) involving the evaluation of a higher of items (n=18), is assessed, based on the new classification system for periodontal and peri-implant condition, improving thus the understanding, the teachability, and comprehension of the patient's periodontal/peri-implant condition, observing the progression and potential risk factors.

Compared to one of the most important tools (PRA) [7], which intends to help generate data and information for the clinician, GF-PeDRA© has thrice the number of parameters. The criteria used in PRA are summarized in a hexagonal functional diagram, identifying patients as low, moderate, or high risk. All the factors assessed were also included in the new AI tool (GF-PeDRA©), and are: (1) probing pocket depth (PPD), (2) Tooth loss (number of missing teeth from 1 to 28 [wisdom teeth are not included]), (3) BoP (bleeding on probing), (4) Bone loss over age (BL/age, % alveolar bone loss) – reporting the amount of alveolar bone loss at the most advanced site in increments of 10% (if used periapical radiographs, the % alveolar bone loss is compared with the distance 1mm apical from the cement-enamel junction (CEJ) to the root apex; if bitewing radiographs, percentual [%] alveolar bone loss is calculated with 10% per 1mm), (5) the environment considering only smoker condition (non-smoker, former smoker [if tobacco use cessation preceded 5 years or more], occasional smoker [for up to 10 cigarettes per day], smoker [for up to 20 cigarettes per day]), and heavy smoker [more than 20 cigarettes per day are used], and (6) Systemic condition of the patient (considered Diabetes type I or II, IL-1 polymorphism, or stress).

Even though this risk assessment system is validated and internationally used, with advances in research and changes in the classification, non-precise or complete information has been transmitted to dentists and patients, which is grounded only in a low number of factors. For example, PRA permits: (1) selection of 2, 4, or 6 sites per tooth/implant; (2) it considers tooth loss without the justification of the reason for the extraction performed; (3) factors/parameters are lacking to evaluate more precisely the severity (interdental clinical attachment loss [CAL]), complexity (furcation involvement; masticatory dysfunction; secondary occlusal trauma; severe ridge defects, bite collapse, drifting, flaring; less than 20 remaining teeth), and extension (localized, generalized, or molar/incisor pattern) of the disease; (4) it includes significantly personal parameters which are difficult to define and compare, such as stress and socio-economic factors, and (5) all parameters included in the PRA system have the same weight, which can generate a non-realistic result, although this fact is not simple to adjust.

Other tools were developed to improve the patient's assessment. One was the Modified Periodontal Risk Assessment (M-PRA) [8], designed to address limitations in the traditional PRA model, incorporating additional risk factors and refining the weight of existing ones. It retained four PRA factors (BoP, number of sites with PPD $\geq$ 5 mm, tooth loss, and smoking) and re-defined or included others, genetic factors, systemic conditions beyond diabetes, and more detailed assessments of local factors such as plaque control and occlusal trauma. M-PRA differs from PRA in (1) the environmental factors - systemic and genetic factors are specifically defined as diabetes status and the interplay of dental-systemic factors that account for dental factors, (2) BL/age is replaced with attachment level/age, (3) other factors such as the estimative of the socio-economic or stress, and (4) the scores on each trajectory ranged between 1 and 5/based on a coding system rather than using actual factor thresholds such as BoP percent, or numbers of pockets $\geq$ 5 mm. This tool, M-PRA, improved the patient assessment, but some items are not simple to define (e.g., socio-economical characteristics and stress).

Genetic factors are correlated to predisposition and play a crucial role in periodontal disease susceptibility. Polymorphisms in specific genes, such as those encoding interleukins and other inflammatory mediators, have been linked to an increased risk of periodontitis [9]. Even though it is highly important, it is not a simple factor to be observed and was indirectly approached in GF-PeDRA $\circledR$. Systemic conditions beyond diabetes permit understanding reciprocal actuation of other systemic conditions (cardiovascular disease, osteoporosis, and obesity, e.g.) on the periodontal condition and vice-versa. These conditions are associated with systemic inflammation, exacerbating periodontal disease [10]. The importance of local factors was considered in the M-PRA model, which places great emphasis on plaque control, occlusal trauma, and the presence of restorations, which can act as plaque traps and contribute to periodontal disease [11]. Owing to the importance of these local factors, GF-PeDRA $\circledR$ also considered including them.

In 2010, Lindskog et al. [12] presented an algorithm that is a web-based analytic tool that integrates some risk predictors. The tool calculates scores indicating levels of risk for chronic periodontitis in the dentition (Level I - patient risk score [DRS_{dentition}]). If an elevated risk is observed, it prognosticates disease progression tooth by tooth (Level II - tooth risk score [DRS_{tooth}]). The systemic predictors used are: (1) age in relation to the history of chronic periodontitis, (2) family history of chronic periodontitis, (3) systemic disease (diabetes, immunopathies and hematologic disorders, hereditary disorders relevant to formation and maintenance of connective tissue and bone, granulomatous disease, osteoporosis, renal disorders, inflammatory vascular disease, Sjögren syndrome, and rheumatism) and related diagnoses (medication leading to decreased salivation, pregnancy, malnutrition and obesity, and alcoholism), (4) result of skin provocation test to assess the patient's inflammatory reactivity, (5) patient cooperation and disease awareness, (6) socioeconomic status, (7) smoking habits, and (8) the therapist's experience with periodontal care; whereas for local predictors: (1) bacterial plaque (oral hygiene), (2) endodontic pathology, (3) furcation involvement, (4) angular bony destruction, (5) radiographic marginal bone loss, (6) periodontal probing depth, (7) periodontal bleeding on probing, (8) marginal dental restorations, and (9) increased tooth mobility. Although this is an exciting tool, again, some of the parameters are not easy to define, and significant non-precision is kept.

In addition to PRA, m-PRA, and the web-based analytic tool, other risk assessment models have been developed to provide more comprehensive and individualized assessments. Periodontal Risk Calculator (PRC) is also a web-based tool that integrates a broader range of risk factors, including patient demographics, medical history, and detailed clinical parameters. It provides a more personalized risk profile and is helpful for clinical practice and patient education [13]. Another is the Periodontal Risk Assessment Tool (PRAT), which uses a scoring system based on clinical and systemic risk factors. It was designed to be user-friendly and provides a simple yet effective way for clinicians to assess and communicate periodontal risk [14].

Some parameters were standard for a periodontal assessment tool, such as smoking and diabetes, two of the most significant risk factors or true acknowledged modifiers factors. Smoking has been consistently linked with an increased risk of periodontitis due to its adverse effects on the

immune response and tissue healing [15]. Similarly, diabetes is associated with an elevated risk of periodontal disease, primarily due to the impact of hyperglycemia on immune function and tissue integrity [16]. Other recognized parameters are Periodontal Pocket Depth and BoP, which are direct indicators of periodontal health; probing depth measures pseudo pocket or the severity of tissue destruction, while BoP reflects inflammation level and disease activity [7].

A comparative analysis of risk assessment models revealed significant differences in their approach to risk assessment; some focus more on clinical parameters, whereas others emphasize systemic and genetic factors. Studies have shown that M-PRA and PRC offer higher predictive accuracy compared to traditional PRA, particularly in identifying patients at risk for rapid disease progression [17]. Including genetic and systemic factors in M-PRA enhanced its ability to identify high-risk individuals who may not exhibit severe clinical symptoms; otherwise, it became the assessment more reliable but less practical in the daily application due to the difficulty of having that information. Therefore, the clinical utility of these models varies depending on their complexity and the resources available to the practitioner. For example, PRC and PRAT are more accessible to general practitioners due to their simplicity, while M-PRA and genetic testing require more specialized knowledge and equipment [18]. Similarly to PRC and PRAT, even though there is a higher number of questions and factors to be observed, GF-PeDRA© can be considered a simple tool, with high accuracy.

Moreover, it is possible to observe that the tools developed and reported above are older than the new classification system (2017/2018), making them non-updated, even though they are helpful. GF-PeDRA© is providing an update and includes more reliable items (1. The highest PD; 2. the number of interproximal sites with bone loss; 3. the highest CAL; 4. maximum RBL; 5. %BoP; 6. bone loss pattern; 7. tooth loss including periodontally hopeless teeth; 8. evidence of progression over 5 years; 9. need for complex rehabilitation; 10. patient's age; 11. CAL and biofilm accumulation; 12. smoking; 13. diabetes; 14. extension and distribution of the disease; 15. peri-implant disease; 16. other systemic conditions (other than diabetes); 17. furcation involvement; and 18. necrotizing lesion), although some are not easy to reach. Also, as a limitation, it is necessary to consider a longer period to obtain all data, making the result more precise and reliable.

Conclusion

The new AI tool (GF-PeDRA©) was validated and proved to be extremely helpful in diagnosing periodontal/peri-implant conditions. It provides a new and feasible score system for risk assessment (GF-PeDRA© score) and prognosis of periodontal treatments. Therefore, the longitudinal evaluation of patients is recommended to confirm the proposed prognosis and improve the reliability of this new system.

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