International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

An Updated Review of Clinical Risk Assessment Models to Evaluate Periodontal Disease Progression

Dr. Shankar S Menon[1], Dr. K V Arun[2], Dr. Biju Balakrishnan[3], Dr. Anjali R Nath[4]

[1]Postgraduate Resident, Department of Periodontics, Amrita Vishwa Vidyapeetham, Kochi, India
[2]Head of Department, Department of Periodontics, Amrita Vishwa Vidyapeetham, Kochi, India
[3]Professor, Department of Periodontics, Amrita Vishwa Vidyapeetham, Kochi, India
[4]Reader, Department of Periodontics, Amrita Vishwa Vidyapeetham, Kochi, India

Abstract

Contemporary periodontal practice envisages personalised risk assessment so as to identify individual therapeutic targets that may mitigate disease progression. Personalised periodontics may involve identification of genomes/epigenomes and metagenomics, all of which are technically demanding and expensive. Clinically available tools are therefore required for disease surveillance, especially in large populations with huge socioeconomic disparities. This review examines existing clinical tools assessing modifiable risk factors like tobacco smoking, diabetes mellitus, and pathogenic bacteria, and non-modifiable risk factors like genetic factors, host response, age, gender, socioeconomic status, and psychological stress. Ten models are analyzed: Hexagonal Risk Diagram (PRA), Modified PRA (MPRA), UniFe/PerioRisk, SmartRisk, DentoRisk, Periodontal Risk Calculator (PreViser), American Academy of Periodontology (AAP) Self-Assessment Tool, Health Improvement in Dental Practice Model (HIDEP), Cronin/Stassen BEDS CHASM Scale, and Risk Assessment-Based Individualized Treatment Model (RABIT). While these models offer unique advantages in predicting risk, there are some limitations in their ability to predict patient outcomes in real-life clinical settings. Further studies need to done to improve upon existing risk models.

Keywords: Periodontal Disease, Risk Assessment, Clinical Tools, PRA, MPRA, UniFe/PerioRisk, SmartRisk, DentoRisk, PreViser, AAP Tool, HIDEP, BEDS CHASM, RABIT

1. Introduction

Contemporary periodontal practice envisages personalised risk assessment so as to identify individual therapeutic targets that may mitigate disease progression. This involves identification of non-modifiable risk factors such as genomic and metagenomic factors. To this end, microbiological tools like Omnigene, Evalusite, and Perioscan; biochemical tools like Perio 2000, Prognos-Stik, Perio-Check, Periogard, and Pocket Watch; and genetic tests like the PST Genetic Susceptibility Test have been devised, but these lack proper scientific validation, consume time, and are also difficult to afford [1]. This warrants the use of clinical tools to evaluate risk assessment. Clinical risk assessment tools aim to evaluate both modifiable

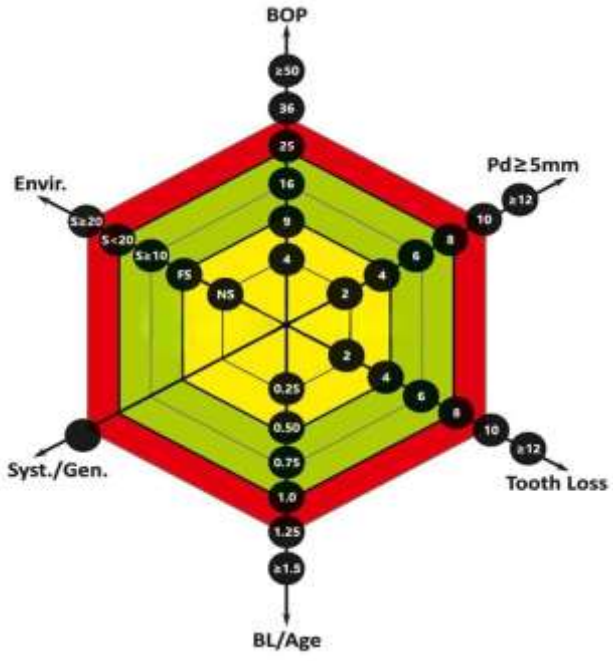
risk factors like tobacco smoking, diabetes mellitus, and pathogenic bacteria and non-modifiable risk factors like genetic factors, host response, age, gender, socioeconomic status, and psychological stress [2]. These are more ideal since they are non-invasive, affordable, quantitative, specific, sensitive, reproducible, and can be performed chair-side with relative ease.

2. Clinical Risk Assessment Models

2.1 Hexagonal Risk Diagram for Periodontal Risk Assessment (PRA)

The PRA tool by Lang and Tonetti employs a hexagonal diagram that integrates six key factors: smoking, diabetes, bleeding on probing, residual teeth, bone loss, and systemic conditions [3]. Since a graphical representation of risk levels of a patient is provided in this tool, it helps in a multifactorial as well as comprehensive approach towards risk assessment as it helps explain risk and risk factors visually to patients [3]. Clinical data (e.g., bleeding on probing percentage, pocket depths ≥5mm, bone loss) should be recorded post-initial therapy, scored (0–3) for six parameters, and plotted on a hexagonal chart; the total area determines risk (low: ≤2 parameters high, moderate: 3–4, high: ≥5). Recall intervals should be set based on the risk category (low: 6–12 months, moderate: 3–6 months, high: 1–3 months). This model is useful particularly in general clinical practice as it can be used for both initial screenings and in long-term monitoring of the patient. Thanks to PRA being readily available on perio-tools.com and its being endorsed by the European Federation of Periodontology, it is widely used in clinical settings [4]. While PRA gives a broad and detailed summary of risk factors when compared with other models, its lack of a specific numerical scoring system limits its precision and reduces its objectivity [5]. Since it has a broad and multifactorial approach, this might overlook specific tooth-level risks, thereby limiting its utility in case of targeted interventions. Moreover, its application across wide demographics may be undermined due to the lack of detailed case-specific validation in diverse populations. Its static nature also does not help its case much: since this does not account for dynamic changes in risk factors over time, sensitivity is reduced in long-term monitoring.

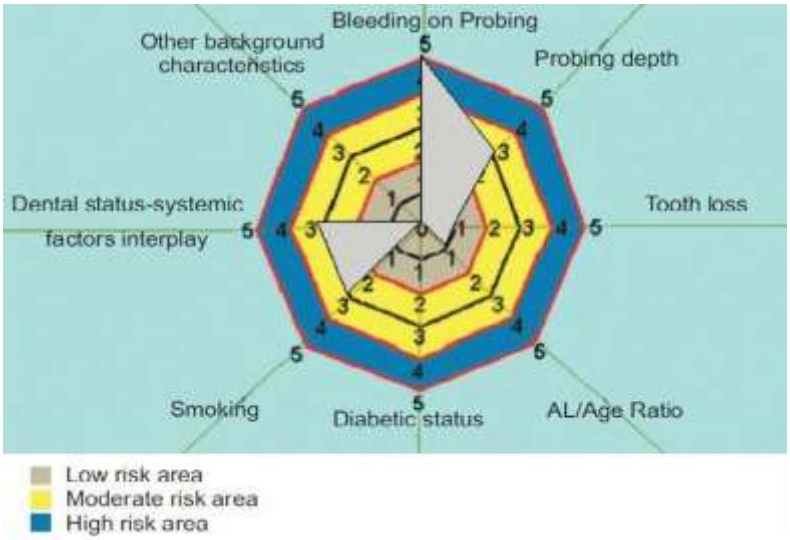
Figure 1: Lang and Tonetti's Hexagonal Risk Diagram



2.2 Modified Periodontal Risk Assessment Model (MPRA)

Developed in India by Chandra, this model is a development on the PRA system with the addition of certain factors such as tooth loss and inflammation [6]. Unlike PRA, it has a numerical scoring system helping increase objectivity in risk evaluation. Data on clinical (e.g., pocket depths) and systemic factors (e.g., diabetes HbA1c, smoking pack-years) should be collected, assigned weighted scores, and combined to categorize risk (low, moderate, high). MPRA model is beneficial in a clinical setup as it aids in individualized treatment planning. Precise quantification of risk makes it valuable for the clinician in terms of decision-making in both surgical and non-surgical periodontal therapy. While this model retains PRA's multifactorial approach, its complexity is increased, thereby reducing ease of usage when compared to PRA as it may overwhelm surgeons as they will mostly be constrained for time in clinical settings; this will reduce its practicality. Its widespread use in diverse clinical practices compared to PRA may also be limited by virtue of its regional development [2]. While the numerical scoring is objective, it may oversimplify complex periodontal conditions and may lead to several risk factors being potentially missed. Lack of supporting literature also limits its credibility and standardization in global clinical practice.

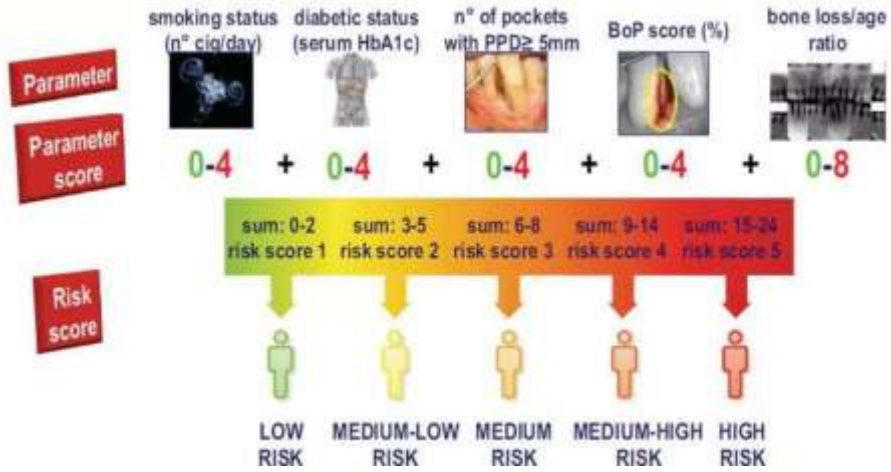
Figure 2: Chandra's Modified Periodontal Risk Assessment Model (MPRA)



2.3 UniFe/PerioRisk

Developed by Trombelli et al., this model divides risk into five categories on the basis of patient characteristics including, but not limited to, age, diabetes, and smoking status [7]. It is tailor-made primarily for large-scale epidemiological studies. In large-scale private dental practice as well as in community health centres where rapid periodontal risk screening is done, this model is seen as being beneficial. It helps in early identification of high-risk individuals, facilitating timely interventions. Unlike the detailed patient risk profiles needed for PRA and MPRA, UniFe/PerioRisk simplifies risk assessment. However, since it has lower specificity in detailed patient evaluations, its use for individualized treatment planning is limited [8]. Since it focuses heavily on epidemiological utility, its adaptability to dynamic clinical changes in individual patients may be limited. As the model relies on broad categories, subtle risk variations within patients might be missed, leading to a reduction in precision. Furthermore, as it is validated in controlled settings and not in diverse clinical practices, its practical applicability could be less.

Figure 3: UniFe/PerioRisk



2.4 SmartRisk

SmartRisk is an advanced digital tool that allows for dynamic prediction of periodontal risk via machine learning. This platform helps minimize subjective bias and adapts over time based on the profile of the patient. SmartRisk is of great advantage when it comes to technology-driven, modern clinical setups. This tool can seamlessly integrate with electronic health records of the patient and give real-time risk updates, thereby making it ideal for multidisciplinary periodontal management [9]. Real-time clinical data (e.g., probing depths, plaque scores) should be entered into the SmartRisk digital platform, which applies the UniFe algorithm to categorize risk (low, moderate, high). Immediate interventions, such as localized antimicrobials, should be assigned, and patients counseled on risk-specific hygiene based on the category. Europe and North America, where practices are more technologically equipped and where electronic health records are prevalent, have shown the adoption of this tool. When compared with traditional models, SmartRisk's approach being AI-driven increases predictive accuracy. However, its reliance on digital tools limits accessibility in resource-constrained environments [10]. Though its dynamic predictions may be accurate, they may need to be updated frequently requiring technical support, thus posing challenges for smaller clinical setups. Clinicians unfamiliar with AI technologies may also find this complex tool difficult to adopt. Its high initial setup costs and reliance on electronic health record integration also make it difficult for limited budget clinics or outdated systems to use this system.

2.5 DentoRisk System

DentoRisk, developed by Lindskog et al., assesses risk at both patient and individual tooth level and was validated in a Swedish patient cohort [11]. It employs a mathematical algorithm for precise risk quantification to categorize risk (low, moderate, high). This model is ideal for advanced periodontal therapy planning, especially in cases requiring tooth-specific interventions. It helps clinicians prioritize treatment for high-risk teeth, improving overall periodontal outcomes. As a web-based tool, DentoRisk is marketed for clinical use (e.g., via dentorisk.com), suggesting it has been applied in specialized periodontal practices, though specific case reports are not widely published. While other models assess risk at the patient level, DentoRisk's tooth-specific analysis allows for targeted treatment. However, its complexity and need for software-assisted analysis may hinder widespread use as it may overwhelm clinicians without technical training, reducing its accessibility. As it focuses on tooth-level risk, it might

under-emphasize broader patient-level factors, thereby skewing treatment priorities. The tool being validated primarily in a Swedish cohort, limits its applicability to diverse populations with varying periodontal findings. What's more, its web-based nature will require constant internet access and software updates, which may be impractical in rural and tribal settings.

Figure 4: DentoRisk

2.6 Periodontal Risk Calculator (PRC)/PreViser

Introduced by Page and colleagues as the Periodontal Risk Calculator (PreViser) in 2002, this digital platform for assessing risk through clinical metrics like probing depth, bleeding, bone loss, and systemic conditions such as diabetes, has undergone several modifications over the years, including by Persson et al (2003), Martin et al (2010), and Busby et al (2014). It produces a numerical score to shape treatment choices and can be employed in general and specialty dentistry settings. While its design is intuitive to predict risk correctly, and is consistent to aid in clinical standardization, their rigid inputs may gloss over any case nuances, reducing flexibility. Its digital nature also tends to limit greater penetration, affecting its broader adoption.

Figure 5: Periodontal Risk Calculator (PRC)

2.7 American Academy of Periodontology Self-Assessment Tool (AAP Tool)

The AAP Self-Assessment Tool is an online, by-the-patient survey where gingival bleeding, tooth loss, smoking, and systemic health factors are probed, with responses interpreted by clinicians to categorize risk (low, moderate, high). It is used in clinics and outreach programs where it encourages dental consultations initiated by the patients themselves, enhancing early detection. Public health efforts are bolstered by its ease of use. Yet, self-reporting is prone to bias and can compromise accuracy. Since the questions are broad, they lack the specificity needed for intricate clinical decisions, requiring professional follow-up that may delay care in areas that have minimum resources, thus limiting its standalone utility.

2.8 Health Improvement in Dental Practice Model (HIDEP)

HIDEP, a model developed by Fors and Sandberg (2001), blends periodontal risk with health promotion, taking into account smoking, diet, stress, and systemic diseases with responses analysed by clinicians to categorize risk (low, moderate, high). When applied in collaborative practices, it links dental & general health strategies and supports prevention across disciplines. Its holistic view strengthens patient engagement and long-term wellness. Its breadth, however, needs extensive training, proving to be cumbersome to busy clinicians. Focus on lifestyle could dilute periodontal specificity, and the success depends on inter-professional collaboration, which is not possible in disjointed or underfunded systems, curtailing its practical scope.

2.9 Cronin/Stassen BEDS CHASM Scale

The BEDS CHASM Scale developed by Cronin and Stassen (2008) scores Biological (e.g., gingival inflammation), Environmental (e.g., socioeconomic status), Dental (e.g., restorations), Systemic (e.g., hypertension), Cognitive, Habits, Access, and Motivation elements to categorize risk (low, moderate, high). When used clinically it provides a thorough snapshot of risk and guides customized interventions. Risk assessment is wide-ranging. However, its many facets prolong evaluation and strain high-volume settings. Subjective scoring also has the risk of inconsistency, and its complexity needs robust training, potentially rendering it difficult to be used in simpler or resource-scarce practices.

2.10 Risk Assessment-Based Individualized Treatment (RABIT)

RABIT by Sorin T Teich (2013) integrates clinical, behavioural, and systemic risks into a flexible framework aiding in personalized periodontal care. Being deployed in specialty settings, it adjusts the treatment as the risks change, and optimizes outcomes via tailored plans. Clinical (e.g., probing depths) and patient-specific data (e.g., genetic markers) should be compiled into the RABIT decision-tree, which assigns a risk level (low, moderate, high) based on the weighted criteria. Its responsiveness suits complex, evolving cases, enhancing patient cooperation. However, its approach is data-heavy and needs time and resources, challenging smaller clinics. Its sophistication may also overwhelm untrained staff and its patchy data access in underserved areas will hamper accuracy and restrict its feasibility across all practice types.

3. Discussion

The ten risk assessment models reviewed here showcase a range of approaches to periodontal care, each tailored to distinct clinical demands. The PRA stands out for its versatility in general practice. According to Costa et al., research conducted in Brazil demonstrated its effectiveness in tracking periodontal health over an extended period, highlighting its utility in routine monitoring [12]. A study by Matuliene et al. where PRA risk profiles were explored to predict tooth loss during long-term maintenance, reinforced its value for clinicians managing chronic cases [13]. Leininger et al. showed in a different investigation how PRA's reliability could help in patient oversight, showing its consistency in supportive therapy settings

[14]. These findings underline the strength of PRA in providing a broad and visual framework. However, its lack of detailed case reports limits deeper insights into individual patient experiences.

MPRA as a tool focuses on precision in treatment planning. Chandra et al. in his initial evaluation in an Indian clinical context showed its potential to guide therapeutic decisions with a structured scoring approach [6]. According to Dhulipalla et al., a separate South Indian study comparing MPRA to PRA, emphasized the ability of MPRA to offer objective risk categorization, which aids in selecting interventions [15]. In a Chinese study by Lu et al., researching to adapt MPRA to local conditions, its flexibility was demonstrated, despite its origins in a specific region [16]. This adaptability suggests that MPRA could serve diverse populations, yet, its limited global testing calls for broader exploration to confirm its practical reach beyond these restricted geographies.

UniFe/PerioRisk is used in large-scale assessments and prioritizes efficiency. Trombelli et al., in an early study validated its screening capabilities by comparing it to another established method and proved its utility in quick risk triage [7]. Further research by the same authors helped to modify the design of this tool to align much better with clinical outcomes so as to enhance its relevance in practice [17]. Farina et al. performed a clinical trial using UniFe to customize supportive care [19]. Thus, UniFe could play role in rapid identification of susceptibility to periodontal risk, though its simplicity may leave certain risk factors unexplored.

Saleh et al. provided a long-term comparison of the prognostic performance of several periodontal risk assessment tools, including PerioRisk, Periodontal Risk Assessment (PRA), Periodontal Risk Calculator (PRC), and the Staging and Grading systems where they aimed to evaluate how effectively these tools predict periodontal disease progression over time. The results indicated that each tool has its strengths, with PerioRisk and the PRA system performing particularly well in identifying high-risk patients. [18].

SmartRisk helped bring into focus the technological side of risk assessment. Trombelli et al. in a retrospective study showed the ability of this tool to help adapt predictions during supportive therapy using AI [9]. Franceschetti et al. confirmed SmartRisk's precision in another evaluation, showing that it could be used in modern clinical setups [20]. Trombelli et al.'s research integrating SmartRisk with digital charting further improved upon its real-time capabilities by offering clinicians with immediate risk updates [21]. This dynamic approach essentially sets SmartRisk apart from the other tools at hand. Its execessive reliance on infrastructure, though, remains a barrier in so far as less advanced settings are concerned.

DentoRisk pin-points tooth-specific risks. Blomlöf et al. in an investigation combined it with a serological test to sharpen its focus on localized periodontal issues [22]. Lindskog et al., in a longitudinal study, expanded its application to track tooth-level risks over years. This helped prove its value in treatment planning [23]. Lindskog et al., in a study, showed its initial validation in Sweden and thereby established for itself a solid base – though its geographic focus which is hence limited raises questions about its wider applicability [11]. Though DentoRisk's precision helps in targeted interventions, its software-driven nature needs broader testing so that it meets diverse clinical needs.

Periodontal Risk Calculator (PRC) presents us a standardized scoring system. Research by Page et al. linked PRC scores to disease progression, thus establishing its relevance in clinical decision-making [24]. Martin et al., in a long-term study, validated its predictive power for tooth loss [25]. Persson et al., in another analysis, compared PRC to judgement of the clinician and highlighted its consistency in risk stratification [26].

AAP Self-Assessment Tool is a bridge between clinical care and public health. Genco et al., in a comprehensive review, noted its use in community outreach programmes and showed that it led to more

frequent dental visits [27]. While direct clinical studies using this tool are limited, its role in educational campaigns cannot be underestimated. The accessibility of this tool makes it a valuable adjunct in preventive care efforts.

HIDEP tool integrates periodontal risk with systemic health of patients. A pilot study by Levine et al. explored its ability to align dental and medical care and showed promise in holistic treatment [28]. Greenwell et al., in another investigation, linked HIDEP to improved periodontal health through coordinated prevention strategies [29]. HIDEP can therefore be positioned as a tool for interdisciplinary collaboration.

BEDS CHASM Scale helps in providing a multidimensional and holistic risk perspective. Cronin, Stassen et al., in an initial trial, showed its capacity to address behavioural risk factors [30].

RABIT focuses on personalized care. Kye et al.'s research over several years showcased its ability to adapt treatment to evolving risks, improving patient outcomes [31]. Its flexibility makes it ideal for complex cases and offers a tailored approach. This however contrasts with broader tools like PRA or UniFe. However, its resource demands indicate a need for wider testing to assess its feasibility across varied practice settings.

These models collectively span a spectrum of clinical utility. The scarcity of detailed case narratives across all tools underscores a gap in individual patient insights, urging further clinical exploration to fully realize their potential [2].

4. Conclusion

21st century technology promises cutting-edge advancements in periodontal risk assessment. This involves tools using artificial intelligence and genetic profiling which have the ability to greatly increase the precision and adaptability of currently available models. Currently available tools ranging from PRA to RABIT provide clinicians with a variety of options that are tailor-made to help offer personalised care to patients. Each of these models though however have inherent shortcomings that need to be looked into. They are best revitalized through AI-powered updates, and by integrating genetic markers and genomic data, rather than relying purely on numerical scores.

Even while technological advancements are underway, they must be supplemented by rigorous trans-continental validation so that they can effectively address the global burden of periodontal disease. It is also equally necessary that studies that are conducted explore chair-side feasibility, affordability and ease of use as well. Concerted efforts need to be made to ensure that these models realize their full potential of envisaging personalised risk assessment so as to identify individual therapeutic targets that may mitigate disease progression.

Table 1: Comparative Overview of Periodontal Risk Assessment Tools

Tool	Design features	Clinical utility	Primary strengths	Limitation	Ease of use	Target setting
PRA	Hexagonal chart, 6 factors	General practice, monitoring	Visual clarity, broad scope	Lacks scoring, static	High	General clinics
MPRA	Adds tooth loss,	Therapy planning	Objective precision	Complex, regional focus	Moderate	Specialty care

	numerical scoring					
UniFe/ PerioRisk	5-level stratification	Large-scale screening	Quick, efficient	Low specificity	High	Community health
SmartRisk	AI-driven, dynamic	Tech-driven care	High accuracy, adaptive	Tech-dependent, costly	Low	Advanced clinics
DentoRisk	Algorithm, tooth-level	Advanced planning	Tooth-specific precision	Software-reliant	Low	Specialty settings
PRC	Digital scoring	General practice	Consistent, user-friendly	Rigid inputs	High	Mixed practices
AAP Tool	Self-reported survey	Public health	Accessible, awareness-focused	Subjective	Very High	Outreach programs
HIDEP	Holistic integration	Multi-disciplinary care	Preventive, comprehensive	Resource-intensive	Moderate	Collaborative care
BEDS CHASM	Multi-dimensional scoring	Complete evaluation	Thorough, team-oriented	Time-intensive	Moderate	Detailed assessments
RABIT	Dynamic, personalized	Specialty care	Tailored, flexible	Data-heavy	Low	Complex cases

5. References

1. Tonetti MS, Claffey N; European Workshop in Periodontology Group C. Advances in the progression of periodontitis and proposal of definitions of a periodontitis case and disease progression for use in risk factor research. J Clin Periodontol. 2005;32(Suppl 6):210-3.
2. Lang NP, Suvan JE, Tonetti MS. Risk factor assessment tools for the prevention of periodontitis progression: a systematic review. J Clin Periodontol. 2015;42(Suppl 16):S59-70.
3. Lang NP, Tonetti MS. Periodontal risk assessment (PRA) for patients in supportive periodontal therapy (SPT). Oral Health Prev Dent. 2003;1(1):7-16.
4. Perio-tools.com [Internet]. Periodontal Risk Assessment (PRA); [cited 2025 Mar 21]. Available from: https://www.perio-tools.com/pra/en/.
5. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. J Periodontol. 2018;89(Suppl 1):S159-72.
6. Chandra RV. Evaluation of a novel periodontal risk assessment model in patients presenting for dental care. Oral Health Prev Dent. 2007;5(1):39-48.
7. Trombelli L, Farina R, Ferrari S, Pasetti P, Calura G. Comparison between two methods for periodontal risk assessment. Minerva Stomatol. 2009;58(6):277-87.
8. Eke PI, Genco RJ. CDC periodontal disease surveillance project: background, objectives, and progress report. J Periodontol. 2007;78(Suppl 7S):1366-71.

9. Trombelli L, Minenna L, Toselli L, Zaetta A, Checchi L, Checchi V, et al. Prognostic value of a simplified method for periodontal risk assessment during supportive periodontal therapy. J Clin Periodontol. 2017;44(1):51-7.
10. Page RC, Martin JA, Krall EA, Mancl L, Garcia RI. Validity and accuracy of a risk calculator in predicting periodontal disease. J Am Dent Assoc. 2002;133(5):569-76.
11. Lindskog S, Blomlöf J, Persson I, Niklason A, Hedin A, Ericsson L, et al. Validation of an algorithm for chronic periodontitis risk assessment and prognostication. J Periodontol. 2010;81(4):584-93.
12. Costa FO, Guimarães AN, Cota LO, Pataro AL, Segundo TK, Cortelli SC, et al. Impact of different periodontitis case definitions on periodontal research. J Oral Sci. 2012;54(2):199-206.
13. 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(8):685-95.
14. Leininger M, Tenenbaum H, Davideau JL. Modified periodontal risk assessment score: long-term predictive value for periodontal disease progression. J Clin Periodontol. 2010;37(5):427-33.
15. Dhulipalla R, Bade S, Bollepalli AC, Katuri KK, Devulapalli NS, Swarna C. Evaluation of Periodontal Risk in Adult Patients using Two Different Risk Assessment Models – A Pilot Study. *J Clin Diagn Res*. 2015 Feb;9(2):ZC25–ZC29.
16. Lu HX, Chen XL, Wong MC, Zhu C, Ye W. Correlation of periodontal conditions with risk factors following 5 years of regular periodontal maintenance. J Periodontal Res. 2013;48(3):356-62.
17. Trombelli L, Farina R, Manfrini R, Tatakis DN. Modulation of clinical expression of plaque-induced gingivitis: effect of personality traits, social responsibilities, and perceived stress. J Periodontol. 2011;82(10):1419-28.
18. Saleh MHA, Dukka H, Troiano G, Ravidà A, Qazi M, Wang HL, et al. Long-term comparison of the prognostic performance of PerioRisk, periodontal risk assessment, periodontal risk calculator, and staging and grading systems. J Periodontol. 2022;93(1):57-68.
19. Farina R, Simonelli A, Baraldi A, Pramstraller M, Minenna L, Toselli L, et al. Tooth loss in complying and non-complying periodontitis patients with different periodontal risk levels during supportive periodontal care. *Clin Oral Investig*. 2021;25(12):6597–606.
20. Franceschetti G, Staufenbiel I, Mazzoni A, Trombelli L. Predicting periodontal risk: the SmartRisk tool. Clin Oral Investig. 2018;22(4):1747-54.
21. Trombelli L, Franceschetti G, Farina R. Effect of professional mechanical plaque removal performed on a long-term, routine basis in the secondary prevention of periodontitis: a systematic review. *J Clin Periodontol*. 2015;42(Suppl. 16):S221–S236.
22. Blomlöf J, Lindskog S, Hammarström L. Periodontal risk assessment using a combination of clinical and serological parameters. J Clin Periodontol. 2012;39(5):467-73.
23. Lindskog S, Persson I, Blomlöf J. Periodontal risk assessment at tooth level: a 3-year longitudinal study. J Clin Periodontol. 2013;40(9):854-60.
24. Page RC, Martin J, Krall EA, Mancl L, Garcia R. Longitudinal validation of a risk calculator for periodontal disease. J Clin Periodontol. 2003;30(9):819-27.
25. Martin JA, Page RC, Kaye EK, Hamed MT, Loeb CF. Periodontitis severity plus risk as a tooth loss predictor. J Periodontol. 2009;80(2):202-9.
26. Persson GR, Mancl LA, Martin J, Page RC. Assessing periodontal disease risk: a comparison of clinicians' assessment versus a computerized tool. J Am Dent Assoc. 2003;134(5):575-82.

27. Genco RJ, Borgnakke WS. Risk factors for periodontal disease. Periodontol 2000. 2013;62(1):59-94.
28. Linabarger M, Brown M, Patel N. A Pilot Study of Integration of Medical and Dental Care in 6 States. *Prev Chronic Dis*. 2021 Jul;18:E72. doi:10.5888/pcd18.210027.
29. Greenwell H, Bissada NF, Wittwer JW. Periodontics in general practice: professional plaque control. J Am Dent Assoc. 2018;149(6):407-12.
30. Cronin AJ, Claffey N, Stassen LF. Who is at risk? Periodontal disease risk analysis made accessible for the general dental practitioner. Br Dent J. 2008 Aug 9;205(3):131-7
31. Kye W, Davidson R, Martin J, Engebretson S. Current status of periodontal risk assessment. *J Evid Based Dent Pract*. 2012;12(Suppl 1):2–11. doi:10.1016/S1532-3382(12)70004-6.