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Quality Resource Guide

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Periodontal Risk Assessment in a General Practice

Educational Objectives

Following this unit of instruction, the practitioner should be able to:

1. Define and understand the rationale for assessing periodontal risk in a general dentistry practice.
2. Understand the difference between a risk factor and a risk indicator.
3. Identify risk factors/indicators for periodontitis and understand how they are used in a risk assessment model.
4. Understand the advantages and disadvantages of the most common periodontal risk assessment tools available today.
5. Understand how to most appropriately use periodontal risk assessment tools in the practice of general dentistry.

Introduction

Periodontal disease is a complex multi-factorial disease caused by the interaction of oral bacteria and the host. Before the 1980s, periodontitis in adults was considered to be a chronic, slowly progressive, disease that affected most adults as they grew older. The difference in the rate of bone loss between individuals was usually explained by differences in oral hygiene. However, our concepts of periodontal diseases have changed over the last 35 years.

Loe and colleagues[1] studied the natural history of periodontal disease in a population of Sri Lankan tea workers who did not perform any oral hygiene and were virtually caries free. They found, after 15 years of following this population, considerable variations in the progression of periodontitis. Approximately 8% of the subjects exhibited rapid progression of clinical attachment loss and eventually lost most or all of their teeth. Approximately 11% demonstrated almost no progression of disease or tooth loss, and the remainder (81%) had intermediate rates of disease progression and tooth loss. Because oral hygiene was virtually the same for all individuals, the results of this study suggested that variability in disease progression was based on other factors. Another study[2] published in the early 1980s demonstrated that periodontal disease progression was episodic with periods of exacerbation and remission, differing in frequency and severity from patient to patient. Since there was variance in the severity of active periodontal disease from patient to patient, studies were conducted to assess characteristics that may predict an individual's risk for periodontitis. These studies introduced the concepts of diagnostics and risk assessment into management of periodontal diseases.[3-5]

Risk Assessment

Risk assessment is defined by the American Academy of Periodontology as "the process by which qualitative or quantitative assessments are made of the likelihood for adverse events to occur as a result of exposure to specific health hazards".[6] The "exposures" in this definition are termed risk factors, or risk indicators, and can be genetic, systemic, clinical, environmental, or behavioral in nature. According to some authors, the term risk factor should be only be used when a causal relationship exists between a specific characteristic and presence of the disease, while a risk indicator is a specific characteristic that is associated with the disease but does not necessarily cause the disease.[7] They are sometimes used interchangeably.

SECOND EDITION

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The following commentary highlights fundamental and commonly accepted practices on the subject matter. The information is intended as a general overview and is for educational purposes only. This information does not constitute legal advice, which can only be provided by an attorney.

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Risk assessment is commonly used in medicine to determine whether a patient warrants intervention or increased monitoring to prevent a disease, or disease-related event, from occurring. The cardiovascular event risk profile developed from the Framingham Heart Study is one of the best-known risk assessment tools used in medicine. A patient's age, gender, cholesterol, HDL level, blood pressure, blood sugar, and smoking history are placed into an algorithm that calculates an individual's risk for future cardiovascular disease. Although it is not ideal, this risk assessment tool has been used to determine whether preventive interventions should be implemented.

Risk assessment for periodontitis uses risk factors/ indicators to predict the likelihood of a patient experiencing active disease in the future. It differs from diagnosis and staging of periodontitis based solely on historic measures of periodontal destruction such as probing depth, clinical attachment loss and radiographic bone loss. The key to developing a clinically useful risk assessment tool for periodontitis is identification of a minimal number of easily obtained risk factors/indicators that accurately predict the future likelihood of disease progression in a specific patient.

Risk Indicators for Periodontitis

Because of the complex nature of periodontitis, a large number of factors/ indicators have been associated with increased risk for periodontal disease progression.[8] The data supporting the use of a specific risk factor/indicator are often based on a cross- sectional relationship of the risk factor/ indicator with the presence of periodontitis. Relatively few longitudinal studies have been performed that examine the ability of a risk factor/indicator to predict future attachment loss.[8]

A summary of important risk factors and indicators are presented in Table 1. Histories of periodontitis, smoking, and/or diabetes, and the current level of gingival inflammation, are considered major risk factors for, or indicators of, future progression of periodontitis. These patient characteristics have been used to develop tools to evaluate risk for periodontal disease progression. Other risk factors/ indicators may be used to modify and improve a risk assessment tool's ability to predict active disease. However, for a risk assessment tool to be useful clinically, it should use a minimal number of readily obtainable clinical data.[9-10]

Periodontal Risk Assessment in General Dentistry Practice

Development of a Risk Assessment Model for Periodontal Disease in General Dentistry Practice: A number of risk assessment models for periodontal disease have been developed over the last 15 years using data from studies that analyzed the risk for periodontitis. These models use 5 to 20 risk factors/indicators to assess the risk of future disease progression.[9] Page and colleagues (2002) developed a computer-based risk assessment tool termed the Periodontal Risk Calculator (PRC).[11] The PRC uses eleven factors/ indicators (age, diabetes, smoking, local factors, various measures of existing periodontitis) to determine a patient's risk profile. A patient is placed into one of five risk categories ranging from low risk (score of 1) to high risk (score of 5). The PRC has demonstrated an ability to predict the progression of periodontitis.[12]

The algorithms used in the PRC were modified for use in another computer-based risk tool named the Periodontal Assessment Tool (PAT). The PAT provides a risk score and a proposed periodontal treatment plan. The PAT demonstrated the ability to reliably predict future bone loss and tooth loss in a 15-year longitudinal study (Table 2). As data in Table 2 illustrates, within 15 years, a patient with a risk score of 5 is approximately 7.6 times more likely to lose a tooth than a patient with a risk score of 2. Because of the proven validity of the PAT in longitudinal studies, it has become the standard to which other risk assessment tools are compared. However, the use of the PAT is limited by the proprietary nature of its algorithm, which requires a fee per use, and by the quantity of information that must be inputted.

Another commonly used risk assessment model, the Periodontal Risk Assessment tool or PRA, was developed by Lang and Tonetti in 2003.[13] It uses six factors/indicators (percentage of sites that exhibit bleeding on probing, number of pocket depths >5 mm, number of teeth lost, radiographic bone loss to age ratio, systemic and/or genetic conditions, and smoking) to determine the level of risk for progression of periodontitis. The PRA differs from the PAT in that the PRA was studied in patients who are undergoing supportive (maintenance) periodontal treatment while the PRC was developed for use prior to initiating periodontal therapy. PRA risk scores have been shown to correlate with the future tooth loss in a retrospective study of periodontitis patients.[14] Other risk assessment models modified the PRA by altering the input factors/indicators,[15] including the inclusion of diabetes as a separate independent risk. The PRA uses a graphic representation of disease probability to inform both the practitioner and the patient about the personal risk factors. The PRA can be accessed online at www.perio-tools.com (University of Berne, Switzerland).

A simplified modification of the PRA, termed the UniFE risk assessment tool, was developed by Trombelli and colleagues in 2009.[16] The UniFE tool (see Table 3) uses only 5 factors/indicators

Table 2

The Validity of the Periodontal Assessment Tool (PAT) used at Baseline to Predict Percent Bone Loss and Percent Tooth Loss at 3 and 15 years.

Risk Score	Percent of Bone Loss		Percent of Teeth Lost	
	3 Years	15 Years	3 Years	15 Years
2	0.7%	3.3%	0.5%	3.1%
3	1.0%	4.0%	1.6%	8.4%
4	1.3%	5.1%	2.1%	11.1%
5	2.5%	6.9%	4.9%	23.7%

Note: Because of the small number of subjects with a risk score of 1, no data from that group is presented. Data from Page, et al.[12]

Table 1

Common Risk Factors or Indicators for Periodontitis

Categories	Characteristics
History of Periodontitis Clinical Attachment Loss Probing Depth Radiographic Bone Loss	There is strong evidence to conclude that the presence of existing periodontal disease is a major risk indicator for future periodontal disease. The greater the extent the disease, the more likely the disease will rapidly progress.
Bleeding on Probing	Bleeding on probing is a marker of the gingival inflammatory response to periodontal bacteria. It is considered a major risk indicator. The lack of bleeding on probing is a strong negative predictor of future attachment loss. Bleeding on probing improves its predictive value when evaluated in conjunction with probing depth.
Diabetes	There is strong evidence to suggest that diabetes is a major risk indicator/factor. Patients with diabetes have been shown to be 2 to 7 times more likely to have periodontal disease. Control of blood glucose has been shown to decrease the risk of future attachment loss.
Smoking	Strong evidence to suggest that smoking is a major risk indicator/factor. Patients who smoke are 2 to 3 times more likely to have progressive periodontal disease. The effect of smoking cessation therapy has been inconclusive.
Periodontal Pathogens *Actinobacter atinomycetemcomitans* *Porphromonas gingivals* *Tanerella forsythus*	The data suggest that certain periodontal pathogens may be considered risk factors/indicators for future periodontal disease. The lack of periodontal pathogens is a strong negative predictor of future attachment loss.
Heredity Family History Genetic Markers	Studies have shown that approximately 50% of periodontal disease may be inherited. Although family history is associated with periodontal disease but has not been useful as a predictor of future attachment loss. Study of genetic markers has not found any specific marker to be a good predictor of future attachment loss.
Age	Some suggestion that age may be a weak risk factor/indicator but the evidence is inconclusive.
HIV Infection	Evidence suggests that HIV infection increases the risk for future attachment loss in patients who are immunodeficient and have existing periodontal disease. Long-term longitudinal data is lacking.
Osteoporosis	There is an association with osteoporosis and future attachment loss but longitudinal data is lacking.
Leukocyte Defects Chadiak-Higashi Syndrome Leukocyte adhesion defects Cyclic and chronic neutropenias	Leukocyte defects may significantly increase the susceptibility to periodontal attachment loss and this can be considered risk indicators/factors. These disorders are rare.
Immunosuppressed Patients Transplant patients Patients taking corticosteroids	The data regarding the effect of immunosuppressive drugs on the progression of periodontal disease has been inconclusive. Differences in studies may be related to the level of immunosuppression and the type of drugs used.
Psychological Conditions Stress Depression	Although there is some data to suggest that either stress or depression is associated with periodontal disease, no conclusive longitudinal data exists.
Table Modified from Page and Beck[9] and Papapanou and Lindhe[21]	

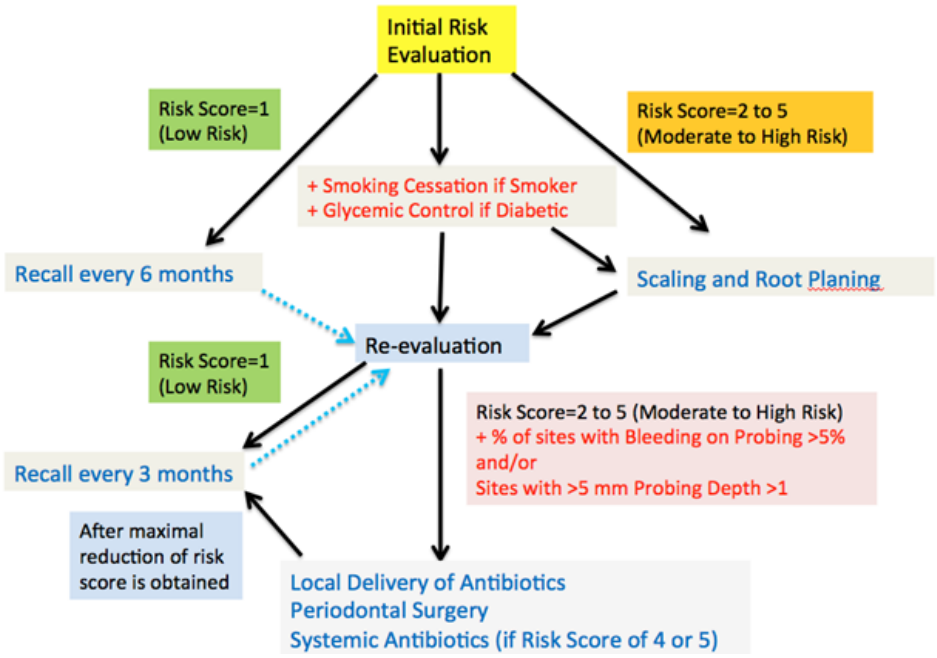
(diabetes, smoking history, number of sites with a pocket depth >5 mm, percentage of sites that exhibit bleeding on probing, and level of radiographic bone loss compared to age) to develop a risk score from 1 (low risk) to 5 (high risk). When risk scores were compared in the same group of patients, the UniFE tool was found to be in 74.8% agreement with PAT risk scores (PAT calculated risk with a kappa statistic of 0.70). These results suggest that risk assessment results using the UniFE tool are similar to the results from the PAT, however; further long-term longitudinal studies need to be performed to verify that result. The advantage of the UniFE risk assessment tool is its simplicity and that it can be completed with or without a computer. It is available online at www.unife.it/parodontologia. In a recent systematic review of periodontal risk assessment tools, Lang et al.[19] reported that In treated populations, results of patient-based risk assessments were able to predict the progression of periodontitis and tooth loss in various populations. However, they noted the need for additional studies to determine the effectiveness of periodontal risk assessment in determining patient specific treatment plans for individual patients.

Developing a Periodontal Risk Profile in a General Dentistry Practice: Every new patient in a general dentistry practice should have risk profiles developed for periodontal disease and caries at their initial visit. To develop a risk profile for periodontitis, a thorough baseline clinical and radiographic evaluation is necessary along with a review of the patient's medical and dental history.[18] The clinical evaluation should consist of a complete periodontal examination including probing depth measurements at six sites per tooth as well a calculation of the percentage of sites that bleed following gentle probing. The reason for any tooth loss should be identified. The radiographic evaluation should include an assessment of the number of teeth with >4 mm interproximal bone loss.

A review of the medical and dental history should include questions related to the patient's history of smoking, or use of tobacco products, as well as other medical conditions, such as diabetes, which can affect the risk for progression of periodontitis. As a precaution, a patient with a family history (sibling or parent) of diabetes should be evaluated for diabetes since the disease is known to cluster in families and is frequently undiagnosed.

Figure 1

Risk Assessment Scores and Management of the Patient with Periodontitis



If the initial Risk Score is 1, the patient should be started on a six-month recall schedule. Recall intervals should be adjusted as necessary to optimize periodontal health.

Information obtained from the clinical examination and medical/dental history is recorded and placed into a risk assessment tool using a computer interface or paper form (Table 2). Based on the calculated risk score, the patient is placed into a risk category. The clinician may modify the risk category obtained from the risk assessment tool if the patient has significant other issues that are not included in the specific risk assessment tool. For example, if a patient, initially placed into the "moderate" risk category (risk score 3) using the UniFE tool, is also an immunodeficient HIV patient, their risk category could be changed to "moderate high" risk (risk score 4) by the clinician. Once the initial risk score is determined, the patient should be informed of their overall risk score as well as the specific risk factors/indicators that have been noted. Many of the online computer based risk assessment tools have a graphical output that visually presents the risk profile.

Use of the Risk Profile in the Management of the Patient with Periodontal Disease: When an initial risk score has been determined, the clinician should have a discussion with the patient about how periodontal disease can be managed and how their specific risk score can be modified. Figure 1 illustrates an example of how a risk assessment score can be used to manage a patient with periodontitis.

All patients, regardless of their risk score, who currently smoke should be offered smoking cessation therapy, and patients with uncontrolled diabetes should be encouraged to see their physician and improve their glycemic control. Patient's with an initial risk score of 1 ("low" risk) may be placed on a 6-month recall interval initially and informed of the importance of recall visits to help maintain their low score. On recall visits, the patient's periodontal status and oral hygiene should be reassessed and if necessary, altered to optimize the patient's periodontal health. Patients with risk scores of 2 to 5

should receive initial periodontal therapy, including root planing and scaling. At the re-evaluation visit following completion of initial therapy, the patient's risk score should be recalculated based on current findings. The patient should be informed of any improvements in their risk score and where further improvements may be possible.Treatment decisions should be in concert with the patient's overall risk score and their specific risk profile. Although the choice of treatment should be based on the patient's specific risk profile, the goal of periodontal treatment should be to reduce overall risk as low as possible. In a systematic review of patient based periodontal risk assessment tools, Lang and colleagues[19] reported that these tools are able to detect the progression of periodontal disease progression and tooth loss in previously treated patients It has been shown that supportive periodontal therapy is particularly important in patients who are categorized as being at moderate to high risk. Therefore, risk assessment scores can be used to determine an appropriate recall interval for patients who have undergone periodontal therapy.

In Summary

Periodontal risk assessment is an evolving discipline within dentistry. Improved risk assessment tools to detect patients who are at highest risk for periodontal disease progression will lead to a more rational approach to periodontal treatment. The development of genetically based risk assessment tools will most likely significantly change our concepts of periodontal risk assessment in the future.

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Table 3

Risk Assessment based on the UniFE Periodontal Risk Assessment Tool (Adapted from Trombelli et al.[16])

1. Smoking Status

Score	Smoking Status
0	Never Smoked
1	Former Smoker
2	1 to 9 Cigarettes per day
3	10 to 19 Cigarettes per Day
4	> 20 Cigarettes per Day

2. Diabetic Status

Score	Diabetic Status
0	Non-Diabetic
2	Controlled Diabetic (Hb1ac<7.0%)
4	Poorly Controlled Diabetic (Hb1ac>7%)

3. Probing Depth

Score	Number of Pockets with Probing Depth of >5 mm
0	0 to 1
1	2 to 4
2	5 to 7
3	8 to 10
4	> 10

4. Bleeding on Probing

Score	Percent of Sites That Exhibit Bleeding on Probing
0	0 - 5%
1	6 - 16%
2	17 - 24%
3	25 - 36%
4	> 36%

5. Bone Loss & Age

Age/Number of Teeth with Radiographic Interproximal Bone Loss of >4 mm

Age	0	1 - 2	3 - 6	7 - 10	> 10
0 - 25	0	8	8	8	8
26 - 40	0	6	6	8	8
41 - 50	0	4	4	6	8
51 - 65	0	2	4	6	8
> 65	0	0	2	4	6

Determination of Risk Score

Risk Score is the sum of the scores for Smoking Status, Diabetic Status, Probing Depth, Bleeding on Probing & Radiographic Bone Loss

Risk Score (Risk Category)	Total Point Score
1 (Low Risk)	0 - 2
2 (Low-Moderate Risk)	3 - 5
3 (Moderate Risk)	6 - 8
4 (Moderate-High Risk)	9 - 14
5 (High Risk)	15 - 24

POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. Which of the following is true concerning Loe and colleagues study of Sri-Lankan Tea Workers?
a. The subjects did not perform oral hygiene.
b. Approximately one-third of the subjects lost all of their teeth after 15 years.
c. They identified that smoking which could account for the differences in bone loss seen in this population.
d. None of the above

2. Which of the following was (were) identified as true during 1980's studies on periodontal disease progression?
a. Periodontal attachment loss was found to be episodic in nature with periods of exacerbation and remission.
b. The rate of periodontal disease progression varied from subject to subject.
c. Both a & b

3. According to the definition of risk assessment by the American Academy of Periodontology, all of the following are true EXCEPT
a. Risk assessment is a process that uses only quantitative assessments.
b. Risk assessment is a measure of the likelihood of an adverse event.
c. To perform a risk assessment, you need to determine whether an exposure to a specific health hazard occurred.
d. "Exposures" can be termed risk factors.

4. Risk assessment can be used to determine:
a. who warrants treatment
b. the frequency of monitoring
c. whether a specific factor can be the cause of a disease
d. All of the above

5. Which of the following are important in developing a risk assessment tool?
a. The information to be inputted into the risk assessment should be easily obtained.
b. The risk indicators must be identified and used to create a risk assessment algorithm.
c. The risk assessment tool should be developed with the minimum possible risk indicators.
d. All of the above

6. All of the following provide you with information about the history of periodontitis EXCEPT:
a. probing depth
b. clinical attachment loss
c. presence of periodontal pathogens
d. radiographic bone loss

7. Which of the following risk factors/risk indicators is considered a major risk factor/indicator for periodontal disease and is used in most risk assessment models for periodontal disease?
a.. Severity of Existing Periodontal Disease
b. Osteoporosis
c. Age
d. HIV infection

8. Periodontal Assessment Tool (PAT) is a modified version of the ____ assessment tool.
a. Periodontal Risk Calculator (PRC)
b. Periodontal Risk Assessment (PRA)
c. UniFE Risk Assessment Tool

9. The absence of which of the following risk factors/ indicators is a good indicator of that periodontal disease is less likely to progress?
a. Periodontal pathogens
b. HIV infection
c. Diabetes
d. Smoking

10. A 55 year old patient who smokes 5 cigarettes a day presents to your office. After a through periodontal evaluation, you determine that he has 8 sites with greater than 6 millimeters of probing depth, 35% of his sites exhibit bleeding on probing, and he has 5 sites with greater than 4 millimeters of radiographic bone loss. Using the UNife (Perio Risk) Periodontal Risk Assessment Tool, you would classify him as having:
a. Low-Moderate Risk (Risk category 2)
b. Moderate Risk (Risk Category 3)
c. Moderate-High Risk (Risk Category 4)
d. High Risk (Risk Category 5)

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