Recent Advances In Periodontal Risk Assessment

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ABSTRACT : Accurate diagnosis, reduction or elimination of causative agents and risk management forms the basis for the prevention and/ or treatment of periodontal disease. Thus it becomes logical to differentiate between risk and diagnosis, as both are vastly different entities. Risk predicts the disease status at some future point in time, including the rate at which an existing disease condition is likely to progress. Diagnosis, by contrast, is an expression of a current disease status. AAP World Workshop 1996, states that "Assessment of risk is an integral part of diagnosing and treating periodontal disease". This article reviews some of the periodontal risk assessment tools including the recent advances for the same.

Key words: Risk factors, Chronic periodontitis, Risk models, Pocket depth, Bleeding on probing

Introduction:

According to Loe et al enormous variability occurs between individuals in their rates of periodontal disease progression. [1] The prevention and treatment of periodontal disease is based on accurate diagnosis, reduction or elimination of causative agents, risk management and correction of the harmful effects of the disease. The American Academy of Periodontology has stated that "the clinical use of risk assessment will become a component of all comprehensive dental and periodontal evaluations as well as part of all periodic dental and periodontal examinations." [2] With an understanding of the risk factors for periodontal disease, a treatment plan to modify, control or eliminate most of these factors can be created.[3]

Risk is defined as the probability that an event will occur in the future, or the probability that an individual develops a given disease or experiences a change in health status during a specified interval of time. [4] Risk assessment has been defined 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 specified health hazards or by the absence of beneficial influences (AAP).[2] As mentioned by the 5th European Workshop on Periodontology, "Effective treatment of periodontitis would be enhanced through development of multifactorial models for risk assessment." [2]

Periodontal Risk Assessment Tools:

In Periodontology, current methods to assess periodontal risk factors include:

1. The oral health information suite (OHIS)

2. Periodontal Risk Calculator (PRC)

3. Hexagonal risk diagram for Periodontal Risk Assessment (PRA)

4. Periodontal risk assessment model developed by Chandra

5. UniFe (Union of European Railway Industries) for periodontal risk assessment

6. AAP Risk Assessment Tool

7. Dentorisk

8. Cronin/Stassen BEDS CHASM Scale

9. Risk Assessment-Based Individualized Treatment (RABIT)

10. Genetic tests

1. The Oral Health Information Suite (OHIS):

OHIS is an information system protected under the U.S. Patent #6,484,144. In addition to quantifying the current periodontal disease state, it also quantifies the risk for future disease. A diagnosis

is made and a risk score as well as a disease score are calculated. Based on these scores, treatment and interventions are ranked and color coded based on the success status as those most likely to be successful, those less likely and those most unlikely to be successful. On re-examination following the treatment procedures, post-treatment risk and disease assessment are performed. Change in the risk and disease state are automatically analyzed by the system and are used to update the risk and disease scores as well as to refine and improve the most appropriate treatments for any given set of conditions.[5, 6]

2. Periodontal Risk Calculator (PRC):

In 2002, Page and colleagues introduced the Periodontal Risk Calculator (PreViser), a component of the Oral Health Information Suite.[7] The PRC is a web-based tool that can be accessed through a dental office computer. The risk calculation is a multi-step process involving mathematical algorithms that use nine risk factors which include:

• Patient age

• Smoking history

• Diagnosis of diabetes

• History of periodontal surgery

• Pocket depth

• Furcation involvements

• Restorations or calculus below the gingival margin

• Radiographic bone height

• Vertical bone lesions.

PRC assigns the individual a level of risk on a scale ranging from 1 (lowest risk) to 5 (highest risk). To document pocket depth and radiographic bone height, a three-point scale is used. An algorithm was developed to quantify disease severity from pocket depth and bone height values. The base risk score is calculated using an algorithm that correlates disease severity with age. The risk score is increased if there is a positive history of periodontal surgery and if the patient smokes more than 10 cigarettes per day or the patient has diabetes that is poorly controlled.

The existence of furcation involvements, vertical bone lesions or subgingival restorations or calculus increase risk when the risk score is otherwise less than four.[4] Based on these parameters, "numeric risk and disease severity scores" are calculated that establish both an assessment of risk and quantification of disease severity. These, in turn, are coupled with suggested treatment options for the clinician.[5,7,8]

3. The Hexagonal Risk Diagram For Periodontal Risk Assessment (PRA):

Lang and Tonetti described a functional diagram based on six parameters for use in estimating an individuals' risk for progression of periodontitis. The PRA model consists of an assessment of the level of infection (proportion of sites with bleeding on probing (BOP), the prevalence of residual periodontal pockets (PPD $\geq$ 5 mm), tooth loss, an estimation of the loss of periodontal support (proportional relationship between root length and radiographic bone loss at the worst site in the posterior region) in relation to the patient's age, an evaluation of systemic and genetic conditions and an evaluation of the environmental/ behavioural factor smoking. If a systemic or genetic factor is known, the area of high risk is marked for this parameter. All other parameters have their own scale for low-, moderate and high–risk profiles.[9]
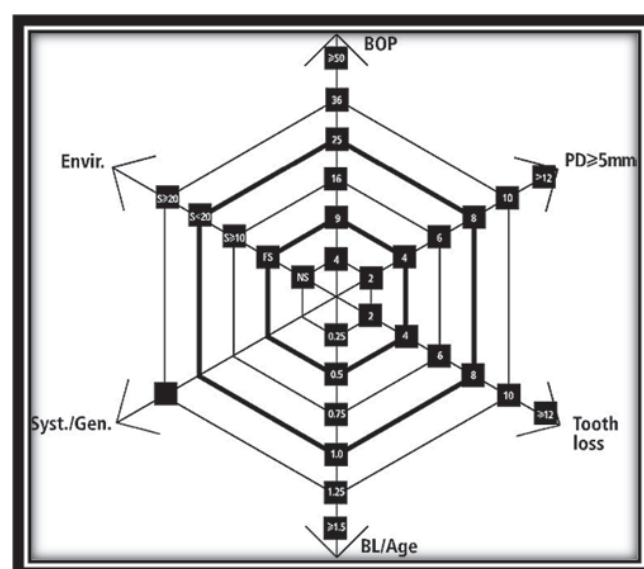

(Figure:1) Functional diagram to evaluate the patient's risk for recurrence of periodontitis.

Each vector represents one risk factor or indicator with an area of relatively low risk, an area of moderate risk and an area of high risk for disease progression. All factors have to be evaluated together and hence, the area of relatively low risk is found within the center circle of the polygon, while the area of high risk is found outside the periphery of the second ring in bold. Between the two rings in bold, there is the area of moderate risk.[9]

4. The Periodontal Risk Assessment Model developed by Chandra:

In 2007, Chandra evaluated a novel periodontal risk assessment model in patients presenting for dental care. This new model based on the periodontal risk assessment model by Lang and Tonetti where the following parameters are recorded: percentage of sites with bleeding on probing, number of sites with pocket depths ≥ 5mm, number of teeth lost, bone loss/age ratio, attachment loss/age ratio, diabetic and smoking status, dental status, other systemic factors and risk determinants. In this model, DM is separated from systemic conditions. It uses a five-point scale for each factor.[17]
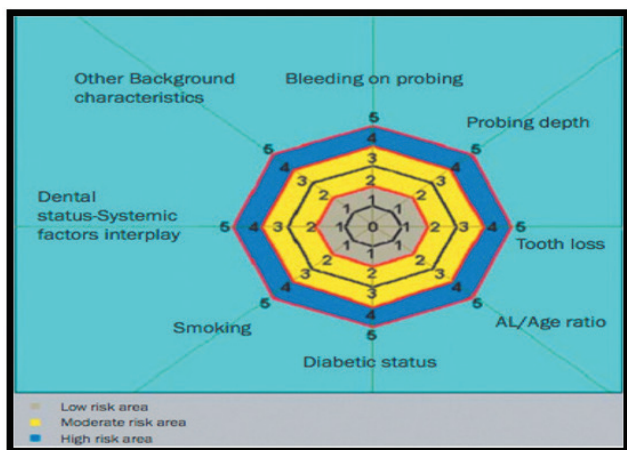

(Figure: 2) The Periodontal Risk Assessment Model

In contrast to the Periodontal Risk Calculator (PRC), which is calculated at the onset of treatment, the PRA provides an assessment of risk for patients during the supportive, post treatment phase, after active therapy has been completed. It is a continuous multilevel risk assessment model that incorporates subjective tooth and site risk assessments and generates a functional diagram, and depending on the area of the polygon categorizes the patient into low-, medium- and high-risk categories. [10, 12]

5. The Simplified Method (UniFe) For Periodontal Risk Assessment:

In 2009, Trombelli and co-workers proposed a new objective method (UniFe) (Union of European Railway Industries) in order to simplify the risk assessment procedures.[11] Risk assessment according to UniFe method is based on five parameters, derived from the patient medical history and clinical recordings. UniFe parameters are as follows: smoking status, diabetic status (both type 1 and type 2), number of sites with probing depth ≥ 5mm, bleeding on probing score, and bone loss/age records.[1]
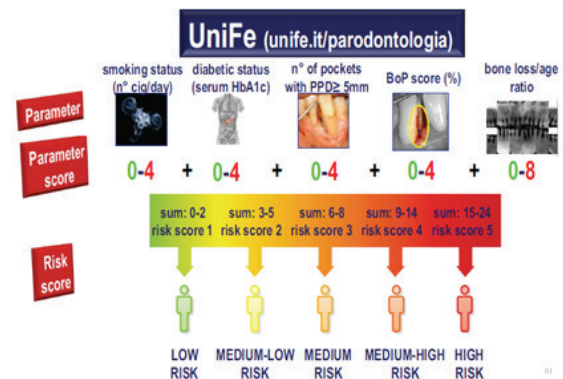
(Figure: 3) UniFe method

6. American Academy Of Periodontology Self-Assessment Tool:

The web based self assessment tool available on the American Academy of Periodontology website is a good example of the value and limitations of how knowledge about the role of individual periodontal risk factors may be used in combination to educate patients, raise awareness and assist in decision making. The tool's web interface is a brief 13−item questionnaire that asks straightforward questions that most persons would be able to answer easily. The items include the person's age (three response options: <40; 40–65; >65 years) and their flossing behavior (daily, weekly, seldom). Other items have simple response choices of yes or no, whereas several items in addition to the yes/no option also include the option of don't know (any of your family members had gum disease, are your teeth loose, do you currently have any of the following health conditions, i.e. heart disease, osteoporosis, osteopenia, high stress or diabetes) or the option of don't remember (seen a dentist in the last 2 years, ever been told that you have gum problems, gum infection or gum inflammation). [5, 12]

The answers to the questions are combined using a proprietary algorithm to yield one of three risk categories: low risk, medium risk or high risk. The website informs users that by using the answers to the questions, the self−assessment tool will help them to see if they are at risk for having or developing periodontal (gum) disease.[12]

7. Dentorisk:

Most recently, Lindskog and coworkers developed a computerized risk assessment and prognostication program (DentoRisk) that is used in conjunction with a skin test for inflammatory reactivity (Dento test).

This model takes 20 factors into consideration including:

Systemic Predictors:

Age in relation to history of chronic periodontitis, family history of chronic periodontitis, systemic disease and related diagnoses, result of skin provocation test, patient cooperation and disease awareness, socioeconomic status, smoking, clinician experience

Local Predictors:

bacterial plaque (oral hygiene), endodontic pathology, furcation involvements, vertical intrabony defects, radiographic marginal bone levels, PD, BOP, marginal dental restorations, increased tooth mobility, missing teeth, abutment teeth, presence of purulence

(Figure: 4) Dentorisk model

This model differs from others in that an assessment is first calculated from patient's overall dentition (Level I). If an elevated risk is detected, a prognosis for annualized attachment loss for each individual tooth (Level II) is then computed. This information can then be used during the treatment planning appointment, and provide the patient and clinician with a current and the future prognostication (based on completion of successful therapy).[13]

8. Cronin/Stassen BEDS CHASM Scale:

This represents a four step risk assessment model. The calculated Odds ratio helps to standardize risk assessment, allowing factors to be easily compared with the standard numerical index

B-BMI	**Score 2**
E-Ethnicity	**Score 1.5**
D-Diabetic	**Score 2.5**
S-Stressed	**Score 2**
C-College	**Score 2.5**
H-Hygiene	**Score 2**
A-Age 65+	**Score 3.5**
S –Smoker	**Score 1.5**
M –Male	**Score 1.5**

The total score of 19 indicates the highest risk.[14]

9. Risk Assessment-Based Individualized Treatment (RABIT)

The RABIT approach differs from the current recall approach by recognizing several points. First, risk assessment is done as part of the initial diagnosis; recall schedules should be automatically generated in the EHR, immediately following risk determination. This approach will ensure that patients with complex treatment plans will have the risk factors addressed and reevaluated also during the active treatment phase and not only after completion of treatment. Second, multiple recall schedules that address different risk factors need to be implemented; not every recall appointment should include the same prophylactic treatments and/ or recommendations. For example, a patient can be scheduled for quarterly appointments because of his
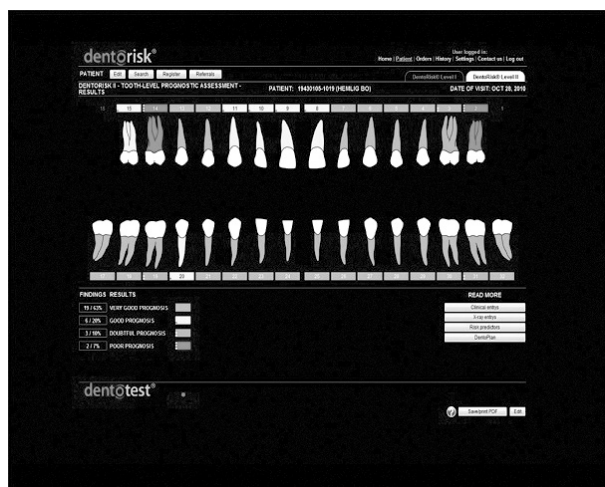
or her periodontal situation, whereas the caries risk dictates a twelve months recall schedule for evaluation of this risk. Third, following periodic reevaluation, the risk for a particular category may change requiring a new recall schedule for that category. Fourth, whenever possible, recall appointments driven by different risk factors should be combined into single recall appointments in order to enhance efficiency and patient compliance. Fifth, the electronic recall system should automatically delete caries risk- and periodontal risk-driven recall schedules when a patient becomes edentulous. [15]

11. Genetic Tests:

Recently, a genetic test was available to test patients for periodontal disease risk. This test determines whether people possess a combination of alleles in two IL-1 genes. Studies have reported an increased frequency of a differentIL-1 genotype in people with advanced adult periodontitis compared with those with early or moderate disease. There isalso retrospective evidence that genetic testing for the specificIL-1 genotype may give indication of increased susceptibility totooth loss in periodontal maintenance patients. A more recent prospective study reported that this composite genotype was not associated with progressive clinical attachment loss during a 2 year period after periodontal therapy. However, it may be concluded that genetic testing has potential for the future, but more research is needed to evaluate its utility.[5, 16]

Clinical Implications:

The aim of risk assessment is to provide the clinician with the opportunity to develop a risk-based treatment plan which will incorporate the level of risk as well as the severity of periodontal disease. It also highlights the opportunity to develop an acurate treatment plan that targets the risk factors, such as periodontal pocket depth, bacteria, tobacco use, and diabetic control for the purpose of reducing risk etc.

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