RISK ASSESSMENT

OUTLINE

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 practice of risk assessment involves dental care providers identifying patients and populations at increased risk of developing periodontal disease. This can have a significant impact on clinical decision-making. Risk assessment reduces the need for complex periodontal therapy, improving patient outcomes and, ultimately, reducing oral health care costs. The awareness of risk factors also helps with the identification and treatment of co-morbidities in the general population as many periodontal disease risk factors are common to other chronic diseases such as diabetes, cardiovascular diseases and stroke

INTRODUCTION:

- **RISK**: Probability that an event will occur in the future (or) the probability that an individual develops a given disease or experience a change in health status during a specified interval of time. **(Kleinbaum.D 1982)**
- According to the Medical Subject Headings (MeSH), risk assessment can be defined as the qualitative or quantitative estimation of the likelihood of adverse effects that may result from exposure to specified health hazards or from the absence of beneficial influences.
- The AAP Guidelines describe risk assessment as "increasingly important in periodontal treatment planning and should be part of every comprehensive dental and periodontal evaluation" (AAP, 2006)

RISK FACTORS	RISK DETERMINANTS	RISK INDICATORS	RISK MARKERS
1. Tobacco Smoking 2. Diabetes 3. Pathogenic bacteria 4. Microbial tooth deposits	1. Genetic factors 2. Age 3. Gender 4. Socioeconomic status 5. Stress	1. HIV/AIDS 2. Osteoporosis 3. Infrequent dental visits	1. Previous history of periodontal disease 2. Bleeding on probing

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Understanding Risk

- In a group or population, this would represent an average risk, incidence or proportion, and may be expressed as the proportion or percentage of persons, expected to experience the condition. As applied to an individual patient, risk may be expressed as the probability or likelihood that the person will develop the disease or have it progress to a measurable outcome.

- A periodontal risk group can be defined as a subgroup (of a larger population) whose members, on average, have a higher probability of developing periodontitis and/or loss of periodontal support, within a given time period, than the remaining population.
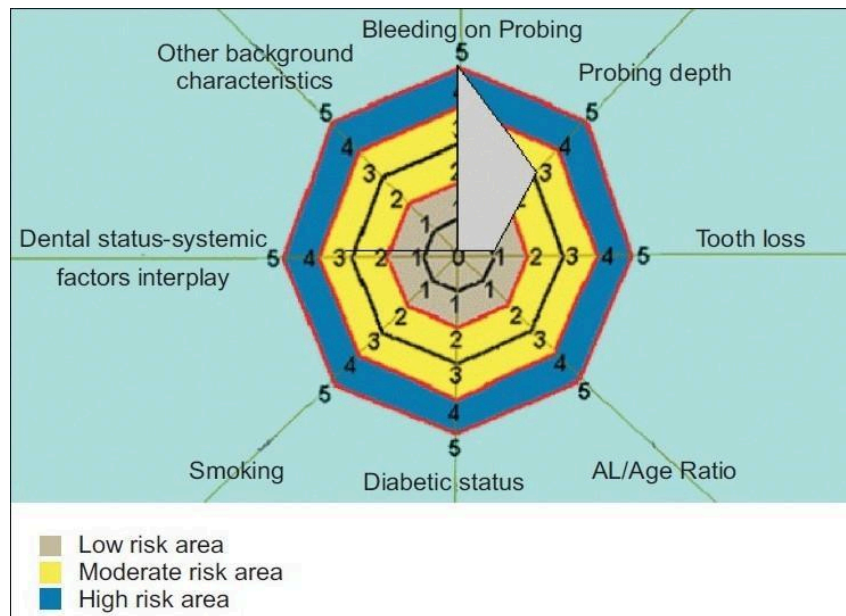
Age as a determinant of Risk

- In cross sectional studies, it is clear that older age groups (65+ years) have increased Attachment Loss.
- Multivariate studies having demonstrated Odds Ratios for Attachment Loss as high as 9.01
- Epidemiological studies reveal more periodontal diseases in older age groups than in younger groups
- More local plaque –retentive factors (Multiple restorations with defects, calculus, deep pockets, teeth with furcation involvement, root caries).
- Up to the age of 80 years, the rate of periodontal destruction is the same throughout adulthood (Axelsson et al,1991,2000)
- Abdllatif and Burt (1987) evaluated the relative importance of age and oral hygiene status and determinants of periodontitis:
- The rate of increase in periodontitis with increasing age was much higher across all age groups for those with poor oral hygiene.

Gender as a risk for periodontal disease

- No established, inherent difference between men and women in their susceptibility to periodontitis; men have been shown to exhibit worse periodontal health than women in multiple studies *(Okamoto et al, 1988; Brown et al,1989; Susin et al,2004)*.

- Difference to be considered a reflection of better oral hygiene *practices (Hugoson et al,1998; Christensen et al, 2003)* &/or increased utilization of oral health care services among women *(Yu et al,2001; Dunlop et al,2002; Roberts-Thomson and Stewart 2003)*.

- NHANES 2009–2010 data collected by the gold standard, full mouth periodontal probing at six sites per tooth, it can be calculated that overall, men had about 50% higher prevalence of periodontitis.

- Men had 33% more mild, 28% more moderate and 180% more severe periodontitis than women, with over half the men affected (56.4%): 10.0% had mild, 33.8% moderate, and 12.6% severe periodontitis.

- Men have poorer oral hygiene than women, as evidenced by higher levels of plaque and calculus.

- Therefore, gender differences in prevalence and severity of periodontitis appear to be related to preventive practices rather than any genetic factor.

Socio-Economic Status as Risk for Periodontitis

- The 1985- 86 US national survey found the prevalence of AL at all levels of severity not closely related to income (Brown and Meskin, 1988).

- Ramfjord (1968) – periodontal condition of young men in India exhibiting symptoms of malnutrition did not differ from that of well-nourished individuals.

- Periodontal status has no association between lower SES and severe periodontal disease (Grossi et al, 1994, 1995).

- Gingivitis and poor oral hygiene can be related to lower socio-economic status.

- This can most likely be attributed to decreased dental awareness and decreased frequency of dental visits compared with more educated individuals with higher SES.

- After adjusting for other risk factors, such as smoking and poor oral hygiene, lower SES alone does not result in increased risk for periodontitis

Risk Predictor/Marker

BOP

- Bleeding on probing best indicator of gingival inflammation
- Alone does not predict alveolar bone loss. Lack of bleeding indicates health
- Widely and commonly used as an indication for needed treatment
- Very weak predictive value for future periodontal breakdown *(Claffey, Nylund et al, 1990; Bedersten et al, 1990).*
- *Kaldahl et al* studied patients on maintenance for 2yrs with data collection every 3 months – BOP was not a predictor for future AL.
- Suppuration was a weak predictor; a good indicator of future AL; its absence did not indicate a lack of future AL
- Repeated absence of BOP is associated with no disease progression *(Lang, Adler, Joss, Nyman,1990 ; Lang, 1991).*

PREVIOUS HISTORY OF PERIODONTAL DISEASE

- H/O previous periodontal disease – good clinical predictor of risk for future disease *(Page and Beck, 1997)*
- Patients with most severe existing LOA are at the greatest risk for future AL.
- Patients currently free of periodontitis – have a decreased risk of developing LOA compared with those who currently have periodontitis.

GENETIC FACTORS

- Genetic traits that may confer enhanced susceptibility to periodontitis (Page et al 1997)
    - o Abnormal phagocyte function
    - o Reduced capacity to produce immunoglobulinG2
    - o HFc gamma R lla polymorphism
    - o Tumor necrosis factor- alpha polymorphism
    - o Variable monocyte and macrophage function
    - o Interleukin-I polymorphism, chromosome 2q1 3
    - o Modifiable risk factors in PD – epigenetic regulation of gene expression in the inflammatory response.

Role of Genetics as Risk in Chronic Periodontitis

- Michalowicz and co-workers (2000) from twin study, attributed a role for genetic factors in chronic periodontal disease.

- They estimated that a substantial portion of the expression of periodontitis in adult chronic periodontitis in twins could be attributed to genetic factors.

- However, Torres de Heens (2010), found a lack of concordance of periodontal findings in Monozygotic Twins. This indicates that the role of Genetics in Chronic Periodontitis, may be overestimated.

SNPs as Risk for Periodontitis

- Kornman et al demonstrated that alterations in specific genes encoding the inflammatory cytokines interleukin-1α (IL-1α) and interleukin-1β (IL-1β) were associated with severe chronic periodontitis in nonsmoking subjects.

- However, results of other studies have shown limited association between these altered genes and the presence of periodontitis.

- Overall, it appears that changes in the IL-1 genes may be only one of several genetic changes involved in the risk for chronic periodontitis.

- Therefore, although the alteration in the IL-1 genes may be a valid marker for periodontitis in defined populations, its usefulness as a genetic marker in the general population may be limited.

SNPs as an Indicator of Risk

- Laine et al, presented a comprehensive literature search up to 2010 and analyzed studies looking at the role of Single Nucleotide polymorphisms in chronic periodontitis

- They pointed out that polymorphisms in the interleukin-1, interleukin-6, interleukin-10, vitamin D receptor, and CD-14 genes as playing a role in chronic periodontitis, but most find that these associations are restricted to certain populations.

- They concluded that there is as yet no gene polymorphism that has definitively been shown to be a risk factor for chronic periodontitis susceptibility in a broad representation of the population.

Genetics as Determinant of Risk

- The mechanism of neutralization of pathogen microorganisms by PMNs involves many different steps: adhesion to capillary endothelium in the inflamed region, trans-endothelial migration, chemotaxis, and phagocytosis and, ultimately, bacterial killing by oxidative and non-oxidative mechanisms.

- A defect in one of these steps leads to altered neutrophil function and, consequently, to a higher host susceptibility to periodontal tissue infection.

- The main intrinsic neutrophil diseases such as neutropenia, leukocyte adhesion deficiency (LAD-1), Chediak-Higashi syndrome, Papillon-Lefèvre syndrome, chronic granulomatous disease (CGD), are often related to severe and early-onset forms of periodontitis.

- Immunologic alterations such as neutrophil abnormalities, monocytic hyper-responsiveness to lipopolysaccharide stimulation in patients with localized aggressive periodontitis, and alterations in the monocyte/macrophage receptors for the Fc portion of antibody, also appear to be under genetic control.

- In addition, genetics play a role in regulating the titer of the protective immunoglobulin G2 (IgG2) antibody response to *A. actinomcetemcomitans* in patients with aggressive periodontitis.

Smoking as Risk Factor

- Papapanou in 1996 conducted a meta-analysis of six studies with a total of 2,361 subjects showed consistency in the findings, for smoking to be a true risk factor in the presence of putative pathogens.

- Grossi et al showed that as the number of pack years increased, the amount of attachment loss was greater

- Bolin et al. reported the results of a 10- year radiographic follow-up, showing that progression of alveolar bone loss was significantly reduced in those who had quit smoking during the study compared with continual smokers

- Preshaw conducted a 12-month study showed that 10 subjects with periodontitis who had continuously refrained from smoking for the entire study period had a significant reduction in probing depths compared with smokers.

- Extent of AL – directly related to serum cotinine levels *(Gongalez, De Nardin,Grossi, 1996).*

- Patel et al, in 2012, in a systematic review of ten studies also found smoking to negatively affect bone regeneration after periodontal treatment.

MICROBIAL TOOTH DEPOSITS

- Meticulous professional and daily plaque control prevents CAL and can arrest established periodontitis.
- Supragingival plaque control following treatment delays recolonisation of subgingival area following treatment.
- Lack of supragingival plaque control following treatment interferes with resolution of inflammation and control of periodontitis.
- Relationship of calculus to periodontitis is complex.
- Oral hygiene reduces the risk for severe periodontitis. *(Page et al, 1997)*

Diabetes as a Risk Factor for Periodontitis

- A two-year follow-up radiographic study of Pima Indians with type 2 diabetes demonstrated that poorer glycemic control leads to both an increased risk for alveolar bone loss and more severe progression of periodontal disease than among those without type 2 diabetes.
- Additionally, it was shown that there may be a less risk for bone-loss progression for those with better controlled type 2 diabetes mellitus than for those with poor control.
- There was an increased rate of alveolar bone-loss progression in individuals with type 2 diabetes compared with those without diabetes.
- Katz et al as part of the NHANES III survey, indicated when compared with those with normal glucose levels, participants with hyperglycemia had more than double the risk (odds ratio = 2.46) for having severe periodontal conditions .

  Periodontal Disease as Complication of Diabetes
- The observed relationship between Diabetes Mellitus and periodontal disease, led Loe et al in 1993, to suggest that periodontal disease is the Sixth complication of Diabetes Mellitus.
- In 1997, the American Diabetes Association stated Periodontal Disease as the sixth complication of DM after retinopathy, nephropathy, neuropathy, and macro-angiopathy and delayed wound healing.

Bi-directional Link between Periodontitis & Diabetes Mellitus

- Four longitudinal studies evaluated the effects of periodontal disease on the future development of type 2 diabetes. Analyses of data from NHANES I found that baseline periodontal disease independently predicts incident diabetes over a mean of 17 years of follow-up.

- Hence, it is suggested that periodontal health is an independent risk factor for the development of type 2 diabetes.

Stress as a Risk Factor

- Emotional stress may interfere with normal immune function, and may result in increased levels of circulating hormones, which can affect the periodontium.

- Stressful life events, such as bereavement and divorce, appear to lead to a greater prevalence of periodontal disease.

- An apparent association exists between psychosocial factors and risk behaviors such as smoking, poor oral hygiene, and chronic periodontitis

- Individuals with financial strain, distress, depression, or inadeuate coping mechanisms have more severe loss of attachment.

- Peruzzo et al (2007) in a systematic review, revealed four of the five studies, taken up for the review had a positive relationship between stress and periodontal disease.

- Hilgert et al. showed that cortisol levels were positively associated with the extent and severity of periodontitis; that is, higher levels were indicative of stress and were associated with higher levels of periodontal disease.

- Rai et al in 2011, showed that salivary cortisol and beta-endorphins were statistically significantly associated with tooth loss and clinical parameters of periodontal disease.

- Rosaina et al, of indicated that salivary cortisol was a significant predictor of the number of missing teeth and also of the number of teeth with clinical attachment loss of >5 mm

- *Genco et al (1999)* – found that stress and distress manifested as depression was a significant risk indicator for more severe periodontitis

Immune suppression as Risk Indicator

- Acquired immunodeficiency may adversely affect host resistance to the presence of bacterial plaque and predispose some individuals to an increase in incidence and/or severity of periodontal diseases.

- The bulk of evidence, however, indicates that gingival recession and loss of clinical attachment occurs more frequently in individuals with AIDS, with or without the signs and symptoms of chronic periodontitis.

- Prevalence & severity of periodontitis – exceptionally high in patients with AIDS *(Winkler & Murray, 1987)*.

- With the use of HAART, incidence of periodontal disease progression in HIV seropositive subjects – resulted in severe periodontal manifestations *(Chapple & Hamburger 2000)*.

- Studies investigating pathobiology of periodontitis in HIV subjects suggested specific IgG subclass responses to periodontopathic bacteria were similar in HIV positive & negative subjects *(Yeung et al, 2002)*.

- HIV-infected individuals may exhibit - Linear gingival erythema, NUG & NUP, severe localized periodontitis & severe destructive necrotizing stomatitis affecting gingiva and bone.

Obesity as a Risk Factor for Periodontitis

Metabolic Syndrome as Risk Factor for Periodontitis

- Shimazaki and coworkers, of 984 Japanese women, showed that metabolic syndrome increases the risk of periodontitis.

- They examined the relationship between periodontitis and five components of metabolic syndrome, including abdominal obesity, triglyceride level, high-density lipoprotein cholesterol level, blood pressure, and fasting plasma glucose.

- The odds ratio for subjects who had four or five of these components was 6.6 for greater pocket depth.

- D'auito et al, found that severe periodontitis was associated with the metabolic syndrome in middle-aged individuals.

- The prevalence of metabolic syndrome was 18% in subjects with no or mild periodontitis, compared with 37% in subjects with severe periodontitis.

- After adjusting for confounders, individuals >45 years of age suffering from periodontitis were 2.3 times more likely to have metabolic syndrome than were individuals with little or no periodontal disease (95% confidence interval: 1.13–4.47).

Osteoporosis as Risk Factor

- Cross-sectional studies confined to postmenopausal women suggested – women with low mineral density are more likely to have AL, gingival recession &/or pronounced gingival inflammation *(von Wowern et al,1994; Mohammed et al,1996; Tezal et al, 2000).*

- *Persson et al (2002)* – reported a positive association between osteoporosis and periodontitis with an Odd's ratio of 1.8.

- Osteoporotic/ osteopenic women exhibited a higher frequency of alveolar bone height loss and crestal and subcrestal density loss relative to women with normal BMD.

- Estrogen deficiency was associated with increased frequency of alveolar bone height and crestal density loss in the osteoporotic/ osteopenic women.

- Osteoporosis – increased risk of tooth loss *(Nicopoulou-Karayianni et al 2009)*

- *Weyant et al, 1999; Lundstrom et al,2001* – found no association between the two.

Dietary Calcium as Risk Factor

- Dietary calcium intake as a contributing risk factor for periodontal disease was studied by Nishida et al

- A dose response was also seen in females, where 54% demonstrated a greater risk of periodontal disease at the lowest level of dietary calcium intake (2–499 mg), and a 27% greater risk in females who took moderate levels of dietary calcium (500–799 mg) as compared to those who took 800 mg or more dietary calcium per day.

- They also found a statistically significant association between total serum calcium and periodontal disease in younger females aged 20–39 with OR = 6.11

Vitamin C as Indicator of Risk

- Nishida et al, also evaluated the role of dietary vitamin C as a risk factor for periodontal disease.They found a relationship between reduced dietary vitamin C and

a minor increased risk for periodontal disease for the overall population (odds ratio [OR] = 1.19; 95% CL: 1.05–1.33)

- They reported a more significant association between the levels of dietary vitamin C and periodontal disease, in smokers and former smokers.

- They concluded that dietary intake of vitamin C showed a weak, but statistically significant, relationship to periodontal disease in current and former smokers.

Oral Hygiene as an Indicator of Risk

- In the 1950s, results from epidemiological studies by Lovdal *et al*. and Schei *et al*. in Norway indicated that groups with poor oral hygiene show a higher prevalence and severity of periodontal tissue loss than populations with good oral hygiene.

- One of the important findings of the NHANES I was that the level of oral hygiene in the population was an important risk indicator for the level of periodontitis, regardless of age.

- Though the level of oral hygiene is an important risk factor for periodontal diseases in population studies, this parameter shows a much weaker value as a predictor of the future occurrence of periodontal tissue loss when assessed on the person level.

Microbial Factors

The ultimate risk factor for an infectious disease is the causative agent of that disease. Without that agent, no disease will take place no matter what other risk factors the subject may possess.

TABLE 3. Risks for Periodontal Disease Progression

Patient-Related Risks	Localized Tooth-Related Risks
Poor Oral Hygiene*	Deep probing depths*
Cigarette Smoking *	Furcation Involvement
Genetics*	Cervical Enamel Projection
Diabetes Mellitus※	Enamel Pearl
Poor Compliance	Palato-Gingiva Grooves
Age	Open Contacts
Sex	Crowding
Race/Ethnicity	Root Proximity
Income	Overhanging Restorations
Osteoporosis	Trauma from Occlusion and Parafunctional habits
Obesity	Root Fractures
Stress	Mobility
Dietary Calcium and Vitamin D	Poor Crown/Root Ratio
Alcohol Use	Poor Root Form
Neutrophil Dysfunction	Restorability
Papillon-Lefevre Syndrome	Endodontic Prognosis
Down Syndrome	Cervical Root Resorption and Cemental Tears
Immunologic Dysfunction	
Pregnancy	
Cardiovascular Disease	
Metabolic Syndrome	
* Strong corelationship to periodontal destruction	

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PATHOGENIC BACTERIA

- 3 specific bacteria – A.actinomycetemcomitans, P.gingivalis, T.forsythia
- Studies support the delineation of these 3 bacteria as risk factors for periodontal disease:
  - o Their elimination or suppression impacts the success of therapy
  - o Host response to these pathogens
  - o Virulence factors are associated with these pathogens
  - o Inoculation into animal models induces periodontal disease.
  - o Higher prevalence and levels of the red complex and *A.a* in subjects with periodontitis in comparison to periodontal health, corroborating the association of these pathogens with disease worldwide, have been reported multiply.

- Only the prevalence of the red complex was strongly related to the periodontal clinical parameters, of Probing Depth, Clinical Attachment Loss and Gingival Bleeding.

Microbial prevalence as Risk Factor

- The three main commonalities of A. actinomycetemcomitans, P. gingivalis, and T. forsythia include:
- All are gram-negative, and therefore produce lipopolysaccharide, which can modulate the local inflammatory response in host cells that express pattern recognition receptors (i.e. TLRs).
- All appear capable of invasion of the mucosal barrier to infection and possibly of being sequestered inside epithelial cells. Thus they can ''wait- out the bad times'' and re-emerge when conditions are permissive for their growth.
- All produce factors that enable them to evade the antibacterial functions of the innate immune response either passively (anti-phagocytic capsule) or actively (leukotoxin, gingipains, other proteases, induction of apoptosis).

TOOTH FACTORS AS CONTRIBUTORS TO RISK

Furcation Involvement as Risk Factor

- "Teeth with furcation invasion are at greater risk than those without such involvement, but even with furcation invasion, teeth can be successfully treated and kept for many years be if proper maintenance occurs."
- Wang et al, based on an eight year longitudinal study, indicated that even after therapy, molar teeth with Furcation Involvement remain at greater risk for loss when compared to teeth without Furcation involvement.

Tooth Mobility as an Indicator of Risk

- Wang et al indicated that Molar teeth with Mobility at baseline or 1 year had more attachment loss at the end of 8 years than the molars without Mobility.
- This is in agreement with Ismail et al., who reported that presence of tooth mobility was a significant risk factor for future attachment loss.

- Zahn et al over a 13-year period, reported that the average attachment loss difference between non-mobile teeth and teeth with a mobility score of 1 was 0.4 mm; while between non-mobile teeth and teeth with a mobility score of > 1, an average of 1.0 mm more attachment was lost

Root abnormalities/ concavities as Risk

- Root abnormalities have been shown to be associated with periodontal breakdown. In particular, palato-gingival grooves in maxillary incisors have been found to be associated with loss of clinical attachment and bone loss.

- In addition proximal root grooves among incisors and maxillary premolars have also been associated with attachment loss and bone loss.

Tooth Mal-position as Risk Indicator

- Tooth position can also present a risk for periodontal disease. Mal-alignment, crowding, and migration or tipping of a tooth distal to an edentulous area have all been implicated in loss of periodontal support.

- In addition, extreme labial or lingual positioning of a tooth has been correlated with gingival recession.

- Tooth malposition poses an even stronger risk among individuals with suboptimal oral hygiene.

Occlusion as a Risk Factor

- Harrell and Nunn in cross-sectional study evaluated the relationship of occlusal discrepancies on a tooth level to periodontal probing depth. Occlusal discrepancies were found to be a stronger predictor of periodontal probing depth.

- In a further longitudinal cohort study to investigate occlusal treatment of these occlusal discrepancies, they showed that teeth with treated occlusal discrepancies had significantly less of an increase in periodontal probing depth than did teeth that did not receive correction of occlusal discrepancies.

Tooth Restorations as Risk Factor

- Tooth restorations can also be a risk factor for periodontal breakdown. This can be the result of marginal discrepancies of restorations or fixed orthodontic appliances.

- Amalgam overhangs have been linked to significant alveolar bone loss.

- Sub-gingival crown margins as opposed to supra-gingival margins have been implicated in increased inflammation and greater gingival recession.

Pulpal Disease as Risk Indicator

- Pulpal involvement may contribute to periodontal destruction, particularly when there is preexisting periodontitis.
- Pulpal necrosis can be associated with inflammatory involvement of the periodontium.
- In addition, when periodontitis is absent, a sinus tract along the periodontal ligament can be caused by an endodontic abscess.
- In some cases, the defect will persist after endodontic therapy, necessitating periodontal therapy as well for complete resolution of the problem.

GOALS OF RISK ASSESSMENT

- o **Prevention**
- o **Early intervention**
- o **Directed therapy**

USE OF RISK ASSESSMENT TOOLS

Periodontal Risk Assessment

- The patient's risk assessment for recurrence of periodontitis may be evaluated on the basis of a number of clinical conditions whereby no single parameter displays a more paramount role.
- The entire spectrum of risk factors and risk indicators ought to be evaluated simultaneously.
- The assessment of the risk level for disease progression in each individual patient would enable the practitioner to determine the frequency and extent of professional support necessary to maintain the attachment levels obtained following active therapy.
- The determination of such risk levels would thus prevent both under treatment, and excessive overtreatment, during SPT.

PRA - Oral Hygiene

- The Oral hygiene is assessed by identifying the percentage of surfaces, that score for the presence of Dental Plaque, after using a disclosing solution.
- The percentage of surfaces with plaque is thereafter, correlated with the functional diagram, that is a product of the host inflammatory burden

Periodontal Risk Assessment

- *Lang and Tonetti (2003)* – described a functional diagram based on six parameters.
- Percentage of bleeding on probing,

    2. Prevalence of residual pockets 5mm or greater,

    3. Loss of teeth from a total of 28 teeth,

    4. Loss of periodontal support in relation to the patient's age,

    5. Systemic and genetic conditions, and

    6. Environmental factors, such as cigarette smoking.

- Each parameter has its own scale for minor, moderate and high-risk profiles.

PRA – Bleeding on Probing

- Bleeding on gentle probing represents an objective inflammatory parameter.
- BOP percentages reflect a summary of the patient's ability to perform proper plaque control, the patient's host response to the bacterial challenge and the patient's compliance, especially when only few residual pockets remain after active periodontal therapy.
- The percentage of BOP, therefore, is used as the first risk factor in the functional diagram of risk assessment.
- The scale runs in a quadratic mode with 4, 9, 16, 25, 36 and > 49% being the critical values on the vector.

PRA- Prevalence of residual pockets ≥5 mm

- The enumeration of pockets >5mm, is done to evaluate the periodontal stability.
- In assessing the patient's risk for disease progression, the number of residual pockets with a probing depth of ≥ 5 mm is assessed as the second risk indicator for recurrent disease in the functional diagram of risk assessment.
- The scale runs in a linear mode with 2, 4, 6, 8, 10 and ≥12% being the critical values on the vector.

- Individuals with up to 4 residual pockets may be regarded as patients with a relatively low risk, while patients with more than 8 residual pockets as individuals with high risk for recurrent disease.

PRA - Loss of teeth from a total of 28 teeth

- The number of remaining teeth in a dentition reflects the functionality of the dentition.

- The number of teeth lost from the dentition without the third molars (28 teeth) is counted, irrespective of their replacement. The scale runs also in a linear mode with 2, 4, 6, 8, 10 and 12 being the critical values on the vector.

- Individuals with up to 4 teeth lost may be regarded as patients in a low risk category, while patients with more than 8 teeth lost may be considered as being in a high-risk category.

PRA - Loss of periodontal support in relation to the patient's age

- The extent and prevalence of periodontal attachment loss (i.e. previous disease experience and susceptibility), as evaluated by the height of the alveolar bone on radiographs, may represent the most obvious indicator of subject risk when related to the patient's age.

- The rate of progression of disease has been positively affected by the treatment rendered and, hence, previous attachment loss in relation to patient's age may be a more accurate indicator during SPT than before active periodontal treatment.

PRA – Assessing the Bone Factor

- The estimation of the loss of alveolar bone is performed in the posterior region on either periapical radiographs, in which the worst site affected is grossly estimated in per cent of the root length or on bitewing radiographs in which the worst site affected is estimated in millimeter.

- On bitewing radiographs, one millimeter is considered to be equal to 10% bone loss. The percentage is then divided by the patient's age. This results in a factor.

- As an example, a 40-year-old patient with 20% of bone loss at the worst affected posterior site would score BL/Age = 0.5. Another 40-year-old patient with 50% bone loss at the worst affected posterior site would score BL/Age = 1.25.

- The scale runs in increments of 0.25 of the factor BL/Age, with 0.5 being the critical value to discriminate between low and moderate risk and 1.0 being the value for moderate and high risk.

PRA -Systemic and genetic aspects

- In assessing the patient's risk for disease progression, systemic factors, if known, are only considered as the fifth risk indicator for recurrent disease in the functional diagram of risk assessment.

- In this case, the area of high risk is marked for this vector. If not known or absent, systemic factors are not taken into account for the overall evaluation of risk.

PRA – Cigarette Smoking

- While non-smokers (NS) and former smokers (FS; more than 5 years since cessation) have a relatively low risk for recurrence of periodontitis, the heavy smokers (HS; as defined by smoking more than one pack per day) were defined as definitely at high risk; ie. > 20 cigarettes per day

- Occasional smokers (OS; < 10 cigarettes a day) and moderate smokers (MS; 10-19 cigarettes a day) are to be considered at moderate risk for disease progression.

- Low PRA Patient - BOP is 15%, 4 residual pockets ≥5 mm are diagnosed, 2 teeth had been lost, the bone factor in relation to the age is 0.25, no systemic factor is known and the patient is a non- smoker.

- Moderate PRA Patient - A medium-risk maintenance patient. BOP is 9%, 6 residual pockets >5 mm are diagnosed, 4 teeth had been lost, the bone factor in relation to the age is 0.75, the patient is a Type I diabetic, but a non-smoker.

  High PRA Patient - BOP is 32%, 10 residual pockets >5 mm are diagnosed, 10 teeth had been lost, the bone factor in relation to the age is 1.25, no systemic factor is known and the patient is an occasional smoker

The Periodontal Risk Assessment Diagram Surface

8 parameters were as follows:

1) Percentage of sites with BOP,

2) Number of sites with PD 5 mm,

3) Number of teeth lost,

4) Attachment loss/age ratio

5) Diabetic status,

6) Smoking,

7) Dental status–systemic factors interplay, and

8) Other background characteristics.

Periodontal Risk Calculator - PRC

- The PRC is a web-based tool that can be accessed through a dental office computer.
- Page et al developed the PRC using the six design parameters, listed below on a desktop computer using Microsoft Excel
  - o PRC calculated risk is for future periodontal disease for those patients who do not yet have it and risk for future progression of periodontal disease for those who already have periodontitis
- 2)All requisite information on risk factors must be obtained during a traditional periodontal examination
- A 5-point risk scale is to be used to balance the sensitivity of risk assessment
- The calculation is a multi-step process using nine risk factors in a mathematical algorithm, that derived a risk score
- - 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 as a Predictive Tool

- This study enrolled 523 men of the VA Dental Longitudinal Study with data gathered over 15 years. The data gathered was retrospectively evaluated with the PRC

- The risk scores applied were strong predictors for the periodontal status as measured by alveolar bone loss of periodontally affected teeth. Increasing risk scores after 15 years also revealed increasing numbers of teeth lost.

- A risk score of 2 corresponded to a loss of 0.5 teeth, a risk score of 3 to a loss of 1.6 teeth, a risk score of 4 a tooth loss of 2.4 teeth and a risk score of 5 a tooth loss of 5.8 teeth.

- The authors recommended the PRC as a predictive tool for risk assessment in clinical decision-making.

The Periodontal Assessment Tool

- It is an *integral part of the Oral Health Information Suite (OHIS)TM*

- It is a *modification of the PRC method*.

- *Method* − Following the input of only twenty-three items taken from a routine periodontal examination, the system generates linguistic and numeric periodontal diagnoses and a risk score for future disease, and prepares a report in two versions. The *traditional documentation of six pocket depth measurements per tooth has been reduced to the deepest pocket for each sextant.* PAT also requires the greatest distance of the bone crest to the cemento-enamel junction determined from radiographs, again using one measurement for each sextant and three categories: <2 mm, 2-4 mm, and >4 mm.

Other Risk Assessment Tools

American academy of periodontology self-assessment tool

- Web-based self-assessment tool

- The tool's web interface is a brief 13-item questionnaire.

- 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, don't know, whereas several items in addition to the yes/no option also include the option of don't know or the option of don't remember. 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.

PreViser was the first interactive, online tool for perio risk assessment, introduced in 2002. An individual record is created online for each patient and then information gathered during examination and charting can be entered into the interactive record.

- Data entered: History of smoking, Diabetes status including HbA1C score, Prior periodontal treatment, and deepest probing depth in each quadrant and bleeding, measures of bone loss - less than 2mm, 2-4mm or more than 4mm.
- PreViser - Perio Risk Assessment (PRA) was introduced in early 2000 and has been validated through scientific clinical studies.
- Sonicare recently introduced online CARE tools: customized assessment and risk evaluator. A team of dentists and hygienists worked to develop this tool, based on scientific evidence and best practices. It consists of several yes or no questions asked about the patient with answers entered into the record
- The American Academy of Periodontology's online tool and the Sonicare CARE program are also available, but without scientific validation.

https://th.bing.com/th/id/R.95d1a38acc87abc7ebe65d257ab7c3c0?rik=DtFRe%2f erzJ7Xjg&riu=http%3a%2f%2fwww.brandquery.com%2fwp-content%2fuploa ds%2fPreviser-Brochure-4.jpg&ehk=Ck32OQFjZMUwP0HfN15CzKB8wOeobi aIPbLkBh7Yy6c%3d&risl=&pid=ImgRaw&r=0

Risk factor assessment tools for the prevention of periodontitis

- Lang and Tonetti in 2015 systematically reviewed the evidence documenting the use of patient-based risk assessment tools for predicting periodontitis progression and tooth loss
- Results from this systematic review indicate that risk assessment tools such as the Periodontal Risk Calculator or the Periodontal Risk Assessment are predictors of periodontitis progression and tooth loss in treated populations.

RISK FACTORS FOR IMPLANT DENTISTRY (Franck Renouard, Bo Rangert)

- *Functional*
- *Esthetic*
- *Biomechanical*

Classification of functional risks

- *Favorable occlusal context* – balanced occlusion, no TMJ pathosis, regular excursive movement of the mandible
- *Moderately unfavorable occlusal context* – presence of small wear facets, development of high masticatory forces, unfavorable occlusal condition without parafunction, reduced inter-arch height
- *Highly unfavorable occlusal context* – bruxism, parafunction, posterior bite collapse, presence of large wear facets, history of cracks or fractures of natural teeth, history of repeated cracks or fractures of prostheses or veneers.

Esthetic risk factors

- **Gingival risk factors** (smile line, gingiva, thickness of keratinized gingiva, papillae of adjacent teeth)
- **Dental risk factors** (form of natural teeth, interdental contact, position of interdental contact)
- **Bone risk factors** (vestibular concavity, adjacent implants, vertical bone resorption, proximal bony peaks)

- **Patient risk factors** (esthetic requirements, hygiene level and availability, provisionalization)

Biomechanical risk factors

- Geometric – number of implants, their relative position, prosthesis geometry
- Occlusal – significant lateral contact in excursive jaw movements and parafunctional habits
- Technological – lack of prosthetic fit and cemented prostheses.
- Bone and implant – dependence on newly formed bone in the absence of good initial mechanical stability and implant diameter that is smaller than the ideal for the situation

The four R's – basic steps for managing periodontal risk factors

- Review the patient's risk factors
- Report the findings to the patient
- Recommend strategies or therapies to reduce risk
- Record all findings and recommendations in the patient's chart

CONCLUSION

Risk assessment can help predict a patient's risk of developing periodontal disease and improve clinical decision making. Patient adherence to a self-care oral health regimen is a key component to successful periodontal disease management. Risk assessment involves identifying elements that either may predispose a patient to developing periodontal disease or may influence the progression of disease that already exists. In either case, these patients may require modification of their prognosis and treatment plan. In addition to an evaluation of the factors contributing to their risk, these patients should be educated concerning their risk. Suitable intervention strategies should be implemented to modify the identified risks to enable the patient to have considerably reduced risk of periodontal disease progression.

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