



Prognosis and its Practical Application in General Dentistry



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Abstract

Prognosis is an important aspect in general dentistry that influences the treatment plan proposed to a patient. Most clinicians in private practice struggle with determining an appropriate prognosis thereby resulting in improper treatment decisions. There are several factors that need to be considered while prognosticating the life span of teeth, among these this article focuses on six factors that have remained most predictable. These factors are simple, practical, and easy, allowing a general dentist to prognosticate and decide how they would like to proceed with treatment.

Keywords: Prognosis; Dentistry; Tooth loss

Introduction

The high percentage (47.2%) of periodontal disease in adults 30 years and older, continues to remain an important health concern in the United States [1]. This chronic inflammatory disease, if left untreated, can result in tooth loss, masticatory dysfunction and poor nutritional status [2]. Several studies have also suggested a possible link between periodontitis and chronic systemic diseases, making this condition warrant early intervention [3]. Most patients with mild forms of the disease can be treated with non-surgical therapy in the general dental office, while others with moderate to severe forms, need surgical intervention. All individuals with periodontitis do not have equal susceptibility to disease progression [4]. Therefore, patients with an elevated risk require close follow up with both the periodontist and general dentist. Understanding and assigning an overall and individual tooth prognosis for these patients, thus plays an integral part of treatment planning.

Prognosis stems from a Latin word that means "foreknowledge". Many prognostication systems have been discussed in literature, but there is little directed evidence about how assigning an appropriate periodontal prognosis translates to future treatment needs. Traditional systems used tooth mortality as the intended measure to define prognosis. However, studies revealed that even severely compromised teeth can be retained in certain patients [5-7]. The extraction of these teeth was therefore driven more by the treatment philosophy of the clinician. We as clinicians need to be aware of several factors while discussing prognosis with the

patient, so that they can then make a sound decision on whether the treatment is worth their time and investment. A commonly adopted prognostication by McGuire and Nunn assigned short term (<5years) and long term (8 years) prognosis based on several clinical factors [8]. However, in their study they could only accurately predict short term prognosis in the good and hopeless category. Predicting long-term prognosis and having multiple categories (poor, questionable) was confusing and inaccurate. When assigning prognosis, it is also important to consider patient-related factors influencing decision-making. A study by Kwok and Caton, which based their prognosis on periodontal stability, offered dental practitioners a better chance at predicting treatment outcome based on patient related factors [9]. Once again however, when analyzing this system, a study in 2020 demonstrated that predicting short term prognosis (<5years) of individual and overall teeth was accurate, but long-term prognosis (>5years) was extremely variable [10]. The survival of teeth with initial prognosis of favorable was most accurate (97.9%), but as the initial prognosis gets worse (questionable, unfavorable, hopeless) the accuracy of predicting tooth loss also decreased (90.7%, 62.5% and 17.7% respectively). An inadequate accuracy of assigning a long-term periodontal prognosis (>8years) may therefore condemn teeth to be extracted by the dentist at an early point in time.

Long-term prognosis gives the patient valuable information, to make an informed decision regarding cost and time involved

in proceeding with the treatment plan. When considering time, patients' age also plays a crucial part in treatment decisions and assigning a prognosis. Patients often want to know what the likelihood is of keeping their teeth to life expectancy. In a study by Arias et al, average life expectancy at birth was 78 years, with female life expectancy of 83 years and male 78 years [11]. Restored teeth in the long term also have a high survival rate. Studies investigating long term survival of single and multi-unit fixed dental prosthesis at university and private settings revealed an average survival rate of 70% over 16-20 years [12,13]. Another study also demonstrated high median average survival rates of 75% for restorations between 11-26 years [14]. So, giving an inaccurate long-term periodontal prognosis (>8years) does not give patients valid information if they wish to proceed with the restorative treatment option provided. All these factors need to be considered concomitantly, to allow patients an opportunity to evaluate treatment options for long term to life expectancy, when applicable. The purpose of this article is to provide dental practitioners with an easy, predictable way of explaining prognosis to the patient, by considering the following factors: Age of the patient, host response, diabetes, smoking, percentage of bone loss and mobility. This article does not intend to create a new prognostication system but reflects 50 years of private practice experience, providing young clinicians a means to discuss prognosis with a patient.

Age

The relationship between age and periodontal disease is complex. Since periodontitis is a non-reversible condition, cumulative destruction manifests more in an older adult compared to a younger individual. 70% of adults 65 years and older have some form of periodontal disease [15]. In most patients, periodontal disease progresses at a slow rate, but in certain patients, their host response to bacterial plaque causes a faster rate of disease progression. Age of onset and rate of progression, therefore, have a key role to play when determining the disease's prognosis. If previous records are unavailable when a patient seeks dental care, the patient's age and percentage of bone loss is the only factor that can be used to describe the nature of disease progression. So, the amount of bone loss due to periodontal disease in an older adults need to be differentiated from that of a younger patient. A 20-year-old patient having more bone loss than an 80-year-old patient raises cause for concern, with the younger patient having a worse prognosis than the older patient. As mentioned earlier, patients also often want to know how long a treatment will last. In an older patient this will need to be considered to life expectancy. Predicting the prognosis for an older patient might, therefore, be easier than a younger patient. For example, it is more difficult to give a prognosis for a 35-year-old female patient with the same percentage of bone loss than a 75-year-old patient. The 35-year-old female has lost more bone in a shorter period and statistically has 48 more years to live to her predicted life expectancy of 83

years. The 75-year-old female has lost less bone over the years and has statically 8 more years to live to her predicted life expectancy, making it easier to predict a favorable (good) prognosis for this patient, accurately.

Host Response to Bacterial Plaque

Host response dictates the patient's susceptibility or resistance to periodontal disease. Bone loss due to periodontal disease is more marked in some patients than others even when differences of oral hygiene are considered. A series of studies conducted on populations with no access to dental care identified 3 broad subpopulations: 11% had no disease progression with an incredibly good resistance to periodontal disease, 80% had moderate progression of disease while the remaining 8% of subjects appear to have a substantial risk of rapid progression of disease and tooth loss [16]. This 10-80-10 rule is backed by several other studies and forms the essence as to why it is important to define a grade (A,B or C) for periodontitis, based on the new classification [17]. 10% of patients who have a high resistance to periodontal disease (Grade A) may have high plaque accumulation, heavy calculus, and few dental visits over their lifetime and still have mild bone loss. If they have lost teeth over time, it may have been due to decay, fracture, trauma, or orthodontics. These patients can safely be seen at 6-month intervals without much concern about disease progression. 80% are susceptible but progress slowly (Grade B) and rarely have tooth loss if they seek early intervention. These patients have varying degrees of progression and resistance to periodontal disease; therefore, they must be monitored closely, many of whom will need surgical intervention, more than once during their lifetime.

This group will be patients that need constant follow up, with a short periodontal maintenance schedule (3 months). The last 10% have an extremely elevated risk of developing destructive periodontal disease and experience a rapid progression of bone loss (Grade C) and tooth loss. Studies have indicated 38-82% of population variance for periodontal disease can be attributed to genetics and cannot be controlled [18]. Despite the best efforts by the dental team, these patients will continue to progress downhill periodontally over the years. To determine an accurate prognosis, the clinician is therefore advised to put each patient into one of the three categories, to provide proper treatment strategies and to set patient expectations. When offering care for a new patient, the host genetics can be understood better by directing questions, as to how often they have sought dental prophylaxis and if they have a family history of periodontal disease. This along with the clinical findings of bone loss and the amount of calculus/plaque accumulation, the clinician can make a strong inference regarding their susceptibility. For example, in a patient 20 years of age, presenting with heavy plaque/calculus build up and mild-moderate bone loss, with limited access to dental care, you can feel confident to achieve superior results with treatment because you

know they have good resistance (host response) to periodontal disease (Grade A), and a favorable (good) prognosis. On the other hand, if the same patient presents with mild deposits, >50% of bone loss, tooth mobility, with frequent access to dental care, this patient may fall into the 3rd (10%) category of rapidly progressing periodontal disease (Grade C). These patients are hard to treat from a periodontal standpoint and have a poor periodontal prognosis. They continue to rapidly progress despite the best efforts of the patient, hygienist, and periodontist. Clinicians should therefore be cautious while providing long term restorative treatment options for these patients. A constant awareness of the patient's susceptibility to the disease will therefore allow dentists to make accurate treatment decisions.

Percentage Bone Loss and Root Length

Percentage of bone loss plays a particularly crucial factor in the predicting both long term periodontal prognosis (to life expectancy 78 years old for men and 83 years old for women) and restorative prognosis. Bone height and root morphology indirectly account for the total number of connective tissue fibers (attachment) connected to the root surface. This root surface area in periodontally healthy periodontium ranges from 65cm² to 85cm² [19]. A patient with low percentage of attachment loss (bone loss) has a better prognosis than a higher percentage of attachment loss (bone loss) at a given age. Clinical attachment loss and bone loss are also strong clinical indicators for the present staging and grading system of periodontitis. To accurately calculate bone loss, it is essential to have updated diagnostic vertical bitewing radiographs that have a visible root apex, at the most severe site. Radiographic bone loss can then be calculated using the measurement tool on any program software. Measure CEJ – root apex (Bone level in health) and CEJ to bone level (bone lost). Remember, 2mm of normal bone level height must be subtracted from both previous measurements. [20] Bone level in health is then divided by bone loss and multiplied by 100 to get a percentage. The new classification uses the percentage of bone loss when defining both a Stage and Grade. The greater the amount of bone loss the higher the stage of periodontitis, however when determining Grade/disease progression, the age of the patient also needs to be taken into account. As discussed earlier, a patient with 10% bone loss has a better long-term prognosis than 25% bone loss, at the same given age. In the current grading system, a patient with 10% bone loss at 40 years of age would be classified as a Grade “A” patient, which indicates slow rate of progression and a patient with 25% bone loss at 40 years is categorized as Grade “B” (moderate rate of progression). Therefore, the patient with 10% attachment loss would have a better long-term prognosis.

Mobility

Tooth mobility is the most common dental concern in a patient with periodontal disease. Patients often also tend to understand tooth mobility better than other clinical factors like probing depth,

clinical attachment, and furcation involvements. There are four factors which influence mobility: 1. Trauma from Occlusion, 2. Bone height (amount of bone encapsulation measured in square millimeters of root surface area), 3. Root morphology (short roots, root resorption, unfavorable root anatomy) and 4. Inflammation. Decreasing tooth mobility is therefore linked to identifying and treating the etiology. Occlusion plays a key role where tooth mobility is concerned. Occlusal trauma is the term used to describe injury of the periodontium (periodontal ligament, alveolar bone, and cementum) due to occlusal forces [21]. There is a strong consensus that excessive occlusal forces do not cause periodontal disease, but the impact of continuous occlusal forces on a reduced periodontium still needs further investigation. A study by Reinhardt et al demonstrated increased stress on the periodontal ligament when 60% of bone support was lost [22]. Occlusal adjustments are therefore recommended when tooth mobility is observed. Depending on the amount of bone lost and mobility observed, the prognosis of a tooth also decreases. Bone height once lost cannot be easily regained if the interproximal bone surface is flat (horizontal bone defects). However, vertical bony defects or circumferential defects with surrounding walls can be regenerated with grafting materials, growth factors, and membranes. Take for instance a bony defect measuring 6mm wide and 3mm deep on a lower molar. If this defect achieves new bone fill or fibrous attachment on attempting regenerative procedures, this will add only 18 mm² of new attachment to the root surface. Whether this would decrease mobility eventually remains questionable.

Moreover, attempting periodontal regeneration procedures can increase the periodontal attachment to the root surface, but the assumption of gaining true regeneration is still debatable. Excessive tooth mobility (Grade 2, 3) more over negatively impacts periodontal healing after regenerative procedures. In these cases, it is advised to decrease tooth mobility by splinting and occlusal adjustments prior to attempting regeneration. In summary teeth with bone loss >50% and excessive tooth mobility has a worse prognosis. Teeth with Grade 1 mobility due to inflammation can be treated and on decreasing inflammation mobility has shown to decrease. Finally, the impact of root morphology (Crown root ratio) in predicting prognosis is a clinical factor for clinicians to consider. If these teeth present with increased mobility, since the root morphology cannot be changed, the prognosis decreases further [23].

Smoking

Smoking has been considered a well-established risk factor in the progression of periodontal disease. It impacts both the microflora and the host immune response thereby triggering dysbiosis. Smoking causes vasoconstriction of the gingival vasculature, reducing the availability of serum-derived protective factors and passage of leukocytes into the periodontal tissues [24]. Smoking also weakens the body's immune system which makes it

harder to fight periodontal disease. It has also been demonstrated through numerous studies that smoking impacts healing after periodontal treatment [25,26]. Smoking status, packs smoked per day, years of smoking, and years since quitting smoking are all significantly associated with tooth loss due to periodontal disease. Male smokers are up to 3.6 times more likely to lose their teeth than non-smokers, whereas female smokers are 2.5 times more likely [27]. Current smokers are in general twice more likely to have periodontal disease than non-smokers. The effects of smoking >10 cigarettes are taken into consideration in the current classification system while assigning a Grade. The Grade reflects on the progression of disease and prognosis. Grade C patients (smoking >10 cigs) are prone to disease progression and bone loss, and therefore have a worse prognosis. Due to the poor host response in current smokers, encouraging patients to quit smoking and warranting frequent maintenance appointments needs to be emphasized.

Diabetes

Epidemiological studies have consistently shown that diabetes is associated with increased risk of periodontitis. Most of the research has focused on type 2 diabetes, however type 1 diabetes also has an identical effect on periodontal disease progression [28]. Diabetics are 2.5 to 3 times more likely to develop periodontal disease than non-diabetics. It does not mean they will definitely have periodontal disease, just three times more likely [29]. Research has demonstrated diabetes to have a two-way relationship with periodontal disease [30]. Accumulation

and activation of advanced glycation end products, reduced host immune cell response, change in microbial populations and alterations in the micro and macro vasculature have been shown to increase the inflammatory response in a diabetic individual, resulting in periodontal disease. Conversely, the steady release of inflammatory mediators due to untreated periodontal disease also affects insulin resistance, which results in increased glycemic levels. The magnitude of risk is known to be dependent on the level of glycemic control. The risk of periodontal disease progression increases exponentially as glycemic control deteriorates. The current classification thus considers the glycemic control while assigning a Grade. A patient with HbA1c > 7.0 is at a higher risk and is assigned a Grade C, also suggesting a worse prognosis. Patients at increased risk are advised to lower glycemic levels and follow shorter maintenance schedules for optimal results.

Conclusion

Private practice experience in dentistry has demonstrated that these 6 prognostic factors have remained most predictable while establishing a treatment plan. Although many factors must be considered, this article explains the factors that have the most influence in determining prognosis. These factors are also simple and easy for general dentists to evaluate prior to deciding a restorative treatment. Furthermore, this method is especially useful in making patients understand the disease process and helps them decide on how they would like to proceed with treatment (Figure 1).

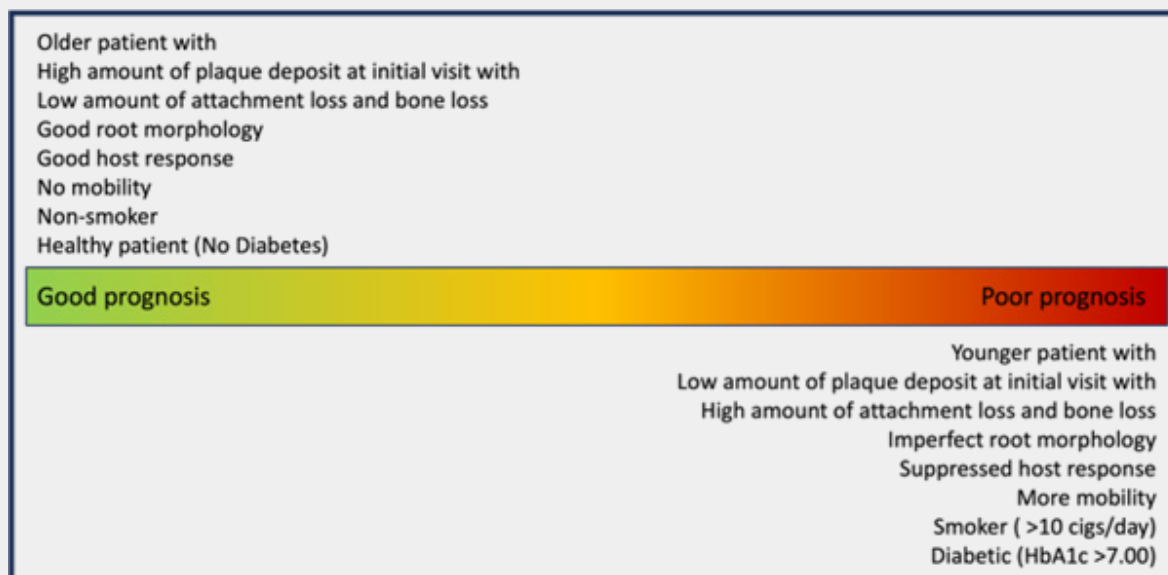


Figure 1: Factors influencing prognosis on a scale from good to poor.

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