

## Management of Rapidly Progressing Periodontitis: An Overview

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### Abstract

*History of periodontal diseases recognition and treatment is ancient for at least 5000 years. There are different presentations of periodontal diseases. Rapidly progression periodontitis or aggressive periodontitis causes rapid destruction of the periodontium which leads to early tooth loss. It may be generalized or localized. Periodontitis may be treated surgically or non-surgically but patients with rapidly progressing periodontitis do not respond predictably to conventional therapy due to its multi factorial etiology. Successful management of the disease is difficult if not diagnosed early and treated appropriately. Regenerative therapy, tissue engineering and genetic technologies are the new hope for the treatment of rapidly progressing periodontitis.*

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### Introduction

Rapidly progressing periodontitis was first described in 1923 as diffuse atrophy of the alveolar bone which after changing a series of terminology finally named as aggressive periodontitis in 1999<sup>1-3</sup>. It is an inflammatory disease affected by a variety of factors as smoking and age as well as diabetes mellitus, stress, gender, education level and immunological diseases such as HIV infection influences the periodontal diseases<sup>4-7</sup>. Periodontal diseases range from the relatively benign gingivitis to chronic and aggressive forms of the diseases. For proper identification and treatment of periodontal diseases it is classified into several categories. Aggressive periodontitis

causes rapid destruction of periodontal ligament and alveolar bone which occurs in otherwise systemically healthy individuals generally of a younger age group but patients may be older<sup>1,8</sup>. A familial aggregation of the disease is also noted<sup>9</sup>. It includes both localized and generalized forms. It was previously known as early onset periodontitis that included three categories of periodontitis - Pubertal, Juvenile and rapidly progressing periodontitis<sup>10,11</sup>. Early diagnosis and appropriate treatment is necessary to prevent early tooth loss.

### Classification

Classification of diseases helps the clinicians to develop a structure which can be used to identify diseases in relation to etiology, pathogenesis and treatment. The most commonly accepted system of classification of periodontal disease has been those of the American Academy of Periodontology (AAP). The recently used definition of aggressive periodontitis was introduced at the 1999 workshop for the classification of periodontal diseases and conditions<sup>12</sup>. In 1989 AAP introduced a classification of periodontal diseases<sup>13</sup> based on:

- a. Presence or absence of clinically detectable inflammation
- b. Extent and pattern of attachment loss
- c. Patient's age at onset
- d. Rate of progression
- e. Presence or absence of miscellaneous signs and symptoms including pain, ulceration and amount of observable plaque and calculus.

Over time various problems with the application of classification were observed and criticisms arose. The classification was revised in 1999 at the workshop for the classification of periodontal diseases and conditions<sup>14</sup>. This resulted in the introduction of a gingival disease category. Adult periodontitis was replaced by chronic periodontitis and early onset periodontitis was replaced by aggressive periodontitis. However a Classification should

not be regarded as a permanent structure. It must be adaptable to change and evolved with the development of new knowledge.

### Epidemiology

The disease is generally found to have a racial and sex predilection with blacks and male teenagers having higher risk for the disease compared to whites and females<sup>15, 16</sup>. The prevalence of severe periodontitis among participants aged approximately 40-50 years estimated were 21% in Germany and 16%, 28% and 32% in various populations from the United States<sup>17-19</sup>. Epidemiological reports show extensive periodontal damage at some sites in adolescents and young adults<sup>20, 21</sup>. There are some data that suggest a prevalence ceiling of 11% for aggressive periodontitis among participants under 26 years of age 18. The study of periodontal conditions among Israeli army personnel in ages between 18-30 years and reported a prevalence of localized aggressive periodontitis of 4% and generalized aggressive periodontitis of 2%<sup>22</sup>. The global prevalence of aggressive periodontitis remains elusive which is reflective of the unresolved debate about its accurate definition.

### Microbiology

The presence of bacteria around the teeth was recognized by Von Leeuwenhoek in the 17<sup>th</sup> century<sup>23, 24</sup>. The microbiologic picture of aggressive periodontitis is complicated. Because only about 50-60% of subgingival microbiota is in "not yet cultivated" category<sup>25</sup>. Certain cultivable pathogens listed by the 1996 workshop in periodontitis including *P. gingivalis*, *T. forsythia*, *C. rectus*, *Eubacterium* sp. *P. micra* and *Treponema* sp.<sup>26</sup>. Preliminary studies have suggested that individuals with aggressive periodontitis have higher subgingival levels of *Selenomonas* sp. and *T. lecithinolyticum*<sup>27,28</sup>. Pathogenic bacteria in the dental plaque specially *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis* have role in aggravated host response<sup>29, 30</sup>. The presence of various types of periodontal pathogens is the main reason that aggressive periodontitis does not respond to conventional periodontal therapy (Scaling with root planning, Oral hygiene instruction & Surgical intervention) alone.

### Clinical Features

Rapidly aggressive periodontitis is characterized by its severe and fast progressing destructive course in young individuals, which often leads to tooth loss early in life followed by the need for prosthetic treatment<sup>31</sup>. Patient may complain of halitosis and pus discharge from gums. Mobility of the affected teeth will be seen towards the

later stages of infection. Gingival recession may be seen and patients may complain of food impaction due to loss of contact points between teeth. Advanced stages of the untreated disease with severe periodontal destruction may show extrusion of teeth, mobility and pathologic migration, furcation involvement, generalized gingival recession and loss of several teeth due to spontaneous exfoliation. Some patients may show systemic manifestations such as weight loss, mental depression and general malaise<sup>32</sup>. **Common features of localized and generalized forms of aggressive periodontitis listed in the 1999 workshop are**<sup>33</sup>:

- except for the presence of periodontitis, patients are otherwise clinically healthy;
- rapid attachment loss and bone destruction;
- familial aggregation.

#### Secondary features that are generally, but not universally, present are:

- amounts of microbial deposits are inconsistent with the severity of periodontal tissue destruction
- elevated proportions of *Actinobacillus actinomycetemcomitans* (*Aggregatibacter actinomycetemcomitans*) and, in some populations, *Porphyromonas gingivalis* may be elevated
- phagocyte abnormalities
- hyper-responsive macrophage phenotype, including elevated levels of PGE2 and IL-1b
- progression of attachment loss and bone loss may be self-arresting.

#### Further specific features were identified:

##### Localized aggressive:

- circumpubertal onset
- localized first molar / incisor presentation with interproximal attachment loss on at least two permanent teeth, one of which is a first molar, and involving no more than two teeth other than first molars and incisors
- robust serum antibody response to infecting agents.

##### Generalized aggressive:

- usually affecting persons under 30 years of age, but patients may be older
- poor serum antibody response to infecting agents
- pronounced episodic nature of the destruction of attachment and alveolar bone

- generalized interproximal attachment loss affecting at least three permanent teeth other than first molars and incisors.

The workshop noted that factors which modify risk, such as cigarette smoking, stress, drugs or sex hormones, which affect the course of all types of periodontal diseases.

### Radiographic Features

Radiographs provide a secondary diagnostic tool and may demonstrate the presence of marginal bone loss thus confirming the attachment loss. Localized aggressive periodontitis typically present radiolucency in the first molars starting from the distal aspect of second premolars to the mesial aspect of the second molar while radiograph of generalized aggressive periodontitis show generalized bone destruction ranging from mild crestal bone resorption to severe extensive alveolar bone destruction. Generalized aggressive periodontitis is characterized by generalized interproximal attachment loss affecting at least three permanent teeth other than first molars and incisors<sup>34</sup>. Comparison of serial radiographs helps in assessing the rapid rate of bone destruction and can aid in the diagnosis of the disease.

### Diagnosis

The diagnosis of the presence of periodontal diseases is made on the basis of evaluation of clinical signs and symptoms and may be supported by evidence from radiographs. Periodontitis is diagnosed by the presence of gingival changes as may be evidence gingivitis plus the presence of reduced resistance of the tissues to periodontal probing with a deeper gingival sulcus or pocket which reflects loss of periodontal attachment<sup>35</sup>. Diagnosis is made according to the criteria set by the American Academy of Periodontology, 1999 classification of periodontal diseases and conditions using history, clinical features and radiographic features aided by microbial examination if needed<sup>1</sup>. Tooth mobility and migration must be assessed. Family history and factors which modify risk such as cigarette smoking, stress, drugs or sex hormones need to be assessed for primary diagnosis. The periodontal probe remains the primary diagnostic tool and is used to detect the presence of periodontal pockets as measured from the gingival margin to the base of the crevice and loss of attachment as measured from the cement-enamel junction to the base of the crevice. The absence of bleeding on probing is used by clinicians as an indicator of periodontal stability<sup>36</sup>. Suppuration has a high specificity for further disease progression in populations with a high prevalence of periodontitis<sup>37, 38</sup>. Significant increase in probing attachment level is the gold standard for the measurement of periodontal disease activity at a

site<sup>39</sup>. Absence of gingival inflammation and shallow probing depths has a strong negative predictive value for periodontal stability<sup>40, 41</sup>.

### Treatment

Protocols for treating aggressive periodontitis are largely empirical and have been subjected to few well controlled comparative studies<sup>42</sup>. The response to periodontal treatment in aggressive periodontitis is much less well understood. The bottom line is that the patient with generalized aggressive periodontitis requires careful monitoring and close collaboration is necessary between all the members of a treatment team.

**Non-surgical management:** Early stage of the disease with mild to moderate periodontal and bone destruction may be managed entirely by non-surgical therapy with systemic antibiotics as an adjuvant to mechanical therapy. The disease can be successfully kept under control by controlling the microbial and environmental factors. Mechanical plaque control can be successfully achieved by educating and motivating the patient with demonstration of brushing techniques (Modified Bass technique for patients without gingival recession and modified stillman technique in patients with hypersensitivity and generalized recession) and use of interdental cleansing aids like dental floss and interdental brushes where indicated. Amine fluoride and stannous fluoride mouth rinses and tooth pastes as an adjunct to mechanical oral hygiene procedures in generalized aggressive periodontitis patients were found to be effective in controlling supra-gingival plaque accumulations in aggressive periodontitis<sup>43, 44</sup>. Smoking has been well documented as a significant risk factor for aggressive periodontitis with generalized aggressive periodontitis patients who smoke having more affected teeth and more loss of clinical attachment than nonsmoking patients with generalized aggressive periodontitis<sup>45</sup>. Photodynamic therapy and laser irradiation have been tried as adjuncts to mechanical therapy to inhibit the pathogenic bacteria in periodontal pockets<sup>46-49</sup>. Both Photodynamic therapy and Scaling and root planning have been shown to have similar clinical results in the non-surgical treatment of aggressive periodontitis<sup>47, 48</sup>.

**Systemic antibiotic therapy:** Systemic antibiotics are indicated in aggressive periodontitis since the pathogenic bacteria like *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis* have been found to be tissue invasive and mechanical therapy is insufficient to eliminate the bacteria from the sites<sup>50, 51</sup>. It is recommended that initiation of antibiotic therapy is done 24 hours before starting scaling and root planning and the root planning is performed over the short time period

during which the antibiotic is prescribed<sup>52</sup>. Tetracycline has the ability to concentrate in the periodontal tissues and inhibit the growth of *A. actinomycetemcomitans*<sup>53</sup>. It was found that GCF levels of repeated doses (250 mg every 6 hours) of tetracycline were two to four times the blood levels after 48 hours<sup>54</sup>. Systemic tetracycline can eliminate tissue bacteria and has been shown to arrest bone loss and suppress microbial levels in conjunction with scaling and root planning<sup>55</sup>. Doxycycline has 7-20 times higher availability in GCF (Gingival Crevicular Fluid) compared to other drugs<sup>56</sup>. It also promotes reattachment, inhibits bone resorption and anti-inflammatory effect. The recommended dose is 100 mg bid on the first day, followed by 100 mg once daily for 14 days<sup>57</sup>. Metronidazole is effective against anaerobes such as *P. gingivalis* and *Prevotella intermedia*<sup>58</sup>. GCF concentration of Minocycline are 5 times as high as serum when 150-200 mg/day age given for 8 days and can remain bacteriostatic for at least one week after treatment is discontinued<sup>59</sup>. Azithromycin is actively transported to sites of inflammation by phagocytes and then released directly into the sites of inflammation as the phagocytes rupture during phagocytosis<sup>60</sup>.

**Serial and Combination therapy:** Periodontal infections contains variety of aerobic, microaerophilic and anaerobic bacteria both gram negative and gram positive. This mixed infection makes it mandatory to use more than one antibiotic either serially or in combination<sup>61</sup>. The preferred combination antibiotic therapy at present for treatment of generalized aggressive periodontitis is 250 mg of amoxicillin thrice daily alone with metronidazole 250 mg twice daily for 8 days<sup>58, 62</sup>. It is one of the most evaluated drug combinations in generalized aggressive periodontitis that significantly improves the result and should be preferred over the antibiotic regimens as the first line treatment<sup>63-68</sup>. Antibiotics that are bacteriostatic (e.g. tetracycline) do not function well if a bactericidal antibiotic (e.g. amoxicillin) is given concurrently. These drugs should prescribe serially not in combination.

**Local delivery of antimicrobial agents:** Local drug delivery delivers the drugs at high concentrations at the site of infection when compared to systemic antibiotic therapy. The use of local delivery of antimicrobial agents to the management of localized aggressive periodontitis is effective when does not respond adequately to mechanical and systemic antibiotic therapy. Adjunctive use of local drugs delivery agents like controlled release biodegradable chlorhexidine gluconate chip, tetracycline fibers and minocycline-HCl gel has been tried in aggressive periodontitis with superior clinical outcomes<sup>69-73</sup>.

**Full mouth disinfection:** It is another approach found improved clinical outcome in rapidly progressing periodontitis compared to scaling and root planning.

This includes scaling and root planning, brushing of the tongue with 1% chlorhexidine for one minute, rinsing of the mouth with 0.2% chlorhexidine solution for two minutes and irrigation of periodontal pockets with 1% chlorhexidine solution. It should be completed in 2 appointments within 24 hours<sup>74</sup>.

**Surgical management:** Surgical management includes open flap debridement either alone or as a combination with resective or regenerative procedures. Bone replacement grafts, barrier membranes or guided tissue regeneration (GTR), biologic modifiers like growth and differentiation factors (GDF) and extracellular matrix proteins like enamel matrix proteins or combination of the above techniques are the regenerative surgical procedures are mostly effective in management of rapidly progressing periodontitis<sup>75</sup>. Biomodification of the root surface (Root conditioning) with citric acid, tetracycline or fibronectin is preferable when performing bone grafting or GTR for better clinical results<sup>75</sup>. The type of bone graft which gives the maximum benefit with minimum tissue reaction is autograft. Commercially available bone grafts are allograft, Xenograft and alloplastic materials.

**Maintenance therapy:** The success of the treatment of aggressive periodontitis depends mostly on the maintenance program. Regular supportive periodontal therapy was found to be effective in maintaining clinical and microbiological improvement attained after active periodontal therapy in early onset periodontitis<sup>76</sup>. It should be continued throughout the life of the patient. If there is any sign of recurrence it should be treated vigorously till resolution of the signs. Sub-gingival scaling in combination with local or systemic delivery of antibiotics is a good way to manage recurring disease<sup>52</sup>.

In conclusion, the management of rapidly progressing periodontitis is much more challenging because of its strong genetic predisposition and some un-modifiable risk factors. The best treatment for these patients is conventional treatment with antimicrobial therapy and regular follow up. The success of the disease depends mostly on its early diagnosis and proper treatment modalities as mentioned above.

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