Prevalence and Evaluation of Bone Loss Pattern among Patient with Aggressive Periodontitis

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Abstract

The objectives of this research were to determine the prevalence, the amount and architecture of alveolar bone loss of Aggressive Periodontitis (AgP), at the Periodontal Clinic, Faculty of Dentistry, UiTM Malaysia.

A retrospective study was done by examining dental records of patients referred to the periodontal clinic at Faculty of Dentistry UiTM Shah Alam from January 2009 until December 2014 for AgP cases based on the 1999 Classification Workshop. A radiographic linear measurement procedure (Planmeca Romexis version 2.9.2 software) was used on their panoramic radiographs (OPGs) to evaluate the pattern and architecture of the alveolar bone loss. Data statistically analyzed using t-test and Simple Pearson's correlation. 2.5% of patients were diagnosed with AgP (13 male and 11 female). Alveolar bone loss (ABL) percentage was demonstrated at mesial of maxillary second molar for both quadrant of male (right=18.50%, left=17.65%) and female (right=10.55%, left=10.24%). For mandibular tooth, ABL percentage at the mesial of right mandibular first molar and distal of left mandibular first molar were on both male (right=8.77%, left=10.08%) and female (right 11.13%, left=9.27%) patients. Significant correlation was observed between ABL percentage on both right and left quadrant of maxilla of male patients. However, for female patients, the correlation is weaker. Percentages of vertical bone defect were found higher at the mesial of maxillary second molar, distal and mesial of maxillary first molar and distal and mesial of mandibular first molar.

Pattern of alveolar bone loss in patients diagnosed with AgP in this study affected the first and second molars, similar to the findings in the literature. ABL showed bilateral or symmetrical pattern. Vertical bone defects were found affecting the molars than the premolars.

Clinical article (J Int Dent Med Res 2017; 10(3): pp. 862-867)

Keywords: Aggressive periodontitis, Alveolar bone loss, Panoramic radiograph.

Received date: 27 July 2017   **Accept date:** 23 September 2017

Introduction

Aggressive periodontitis (AgP) is a rare form of periodontal disease which presented with rapid attachment loss and bone destruction[1]. The disease has on early onset affecting mainly the younger populations. Limited epidemiological studies have been done on the prevalence of the disease, in the Asian regions, the prevalence varies from 0.47% to 1.8 % depending on the case selection and study design done[2-5]. Management of aggressive periodontitis is critical as it has adverse effects on the quality of life[6]. Recognizing the clinical and radiographic features of Ag P is essential so timely and effective treatment can be done[7].

Ideally, the case definition of aggressive periodontitis should be based on distinctive clinical signs and in combination with the presence of key causal factors of the disease. The first comprehensive case definition of aggressive periodontitis proposed by Baer in 1971[8]. Baer defined aggressive periodontitis as 'a disease of the periodontium occurring in an otherwise healthy adolescent, characterized by rapid loss of alveolar bone around more than one tooth of the permanent dentition. He proposed seven criterias to define the disease but now there is sufficient evidence showing that some of the clinical features recommended are not valid. This is because by late 70s, the notion that the

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disease was due to the degenerative process of the cementum was disputed as it has been shown that the condition was due to infection[9-12]. Despite this, some of the clinical features described by Baer have not been significantly modified till this day[7].

In 1999, the American Academic of Periodontology organized a workshop to propose a new classification of periodontal disease and condition based on several criteria. Periodontitis was recognized to have two clinical phenotypes namely; the aggressive and the chronic form[13]. Aggressive periodontitis was classified into localized and generalized form based on several characteristics. The patients are clinically healthy, except for the presence of periodontitis, and rapid attachment loss and bone destruction[14]. Patient has familial aggregation of the disease. For the localized aggressive periodontitis, disease onset is usually during the circumpubertal periodang[14]. Affecting the first molar or incisor with interproximal attachment loss on at least two permanent teeth and involving no more than two teeth other than first molars and incisors[14]. For generalized aggressive periodontitis, it usually affects patients under 30 years of age, but patients can be older. Characterizes with generalized interproximal attachment loss effecting at least three permanent teeth other than first molar and incisors[15]. Since there is no age predilection to distinguish aggressive to chronic form of periodontitis[16, 17], it has been difficult to distinguish the two phenotypes of the disease at an early stage as management of AgP is more demanding[18, 19].

Dental panaromic radiograph (OPG) is widely use as the total number of panoramic examinations exceeds 1.5 million within the general dental services of England and Wales in 1991/1992, representing almost 10% of all dental radiographic examination[20,21,22]. The OPG was selected to measure the bone loss and the bone loss pattern at the posterior region for both maxilla and mandible[23]. The anterior teeth are difficult to access through the OPG because of the overlapping with the vertebrae. Panoramic radiography is not as accurate as intraoral radiography for imaging bone levels in the anterior part of the mouth[24] and the overlap of contacts between teeth in the canine/premolar region can give rise to immeasurable sites[24].

To date the prevalence and study on the amount and/or type of bone loss associated with aggressive periodontitis is lacking in Malaysia. In addition, the pattern of alveolar bone loss has been shown to be associated with different groups of ethnicities. The aim of this study was to first assess the prevalence of aggressive periodontitis among the patients referred to the Periodontal Clinic of Faculty of Dentistry, UiTM Shah Alam from January 2009 to December 2014. The cases diagnosed with AgP were further evaluated according to the criteria set in this study. Furthermore, OPGs of patient diagnosed with aggressive periodontitis is analyzed to determine the amount and architecture of alveolar bone loss in patient with aggressive periodontitis.

Materials and methods

This retrospective study was done by going through the dental records of patients referred to the periodontal clinic at Faculty of Dentistry UiTM Shah Alam from January 2009 until December 2014. Official permission was taken from the Faculty of Dentistry to conduct this research (500-FPG.P2,22/01/2014) . From the data collection, about 978 dental records of patients were retrieved; 256 patients were diagnosed with Gingivitis, 606 were diagnosed with Chronic Periodontitis (CP) and 116 were diagnosed with Aggressive Periodontitis (AgP). The inclusion criteria for enrolment on the study were: 1) patient's must be below 35 years old, 2) patient must have no complicating medical condition or pregnant nor on medication known to affect the periodontium and 3) non-smoker and ex-smoker. For each patient, a panoramic radiograph (OPG) was required. The inclusion criteria of the OPG were: 1) high quality with adequate brightness and contrast and 2) the anatomical landmarks used to measure the bone loss patterns which are the cement-enamel junction (CEJ), alveolar bone crest (AC) and bony defects (BD) must be clearly shown in the radiograph. All the OPGs were collected and measured with Planmeca Romexis software version 2.9.2. Inter and intra examiner calibration was done with Cohen's Kappa test. 669 sites of mesial and distal of tooth from premolar to second molar were measured in each patient.

Pattern of the alveolar bone loss (ABL) on radiographs was divided into horizontal or vertical. The alveolar bone loss is said to occur

when there is more than 2mm of bone loss from the CEJ until bony defects of alveolar bone crest25. ABL were measured from the panoramic radiograph according to the radiographic linear measurement procedure. ABL for premolars, first and second molars will be measured from its most apical point to the cement-enamel junction (CEJ) as a percent of the root length and the total ABL percentage for each jaw were averaged. Distal site of second molar, third molars and all the anterior teeth were excluded from the measurement. If the CEJ can not be traced due to dental restorations, the most apical margin of the restoration will be used as the landmark. Sites with undefined radiopacity due to lack of contrast and brightness will be excluded from the measurement.

The subject information was the unit of analysis in this study. Results were further statistically analysed by using SPSS version 20, Significance level was set at 0.05. A descriptive statistical study (mean, standard deviation) was carried out on the measurements of variables collected. Normality of the variables was measured by normality test. Statistically differences between group means were tested using t-test. Simple Pearson's correlation was used to study the relationship between right and left quadrant of maxilla and mandible.

Results

The results showed that 12% (116 patients) were diagnosed with Aggressive Periodontitis, 26% (256 patients) were diagnosed with Gingivitis and 62% (606 patients) were diagnosed with Chronic Periodontitis (Figure 1.0).
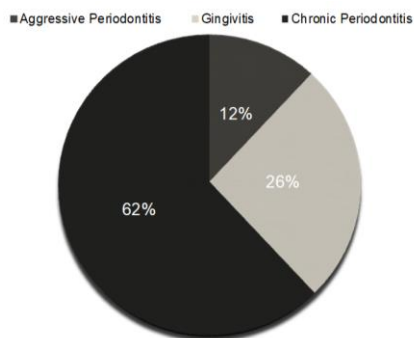

Figure 1. Prevalence of patient diagnosed with periodontal disease at Periodontal Clinic, Faculty of Dentistry UiTM from January 2009 until December 2014.
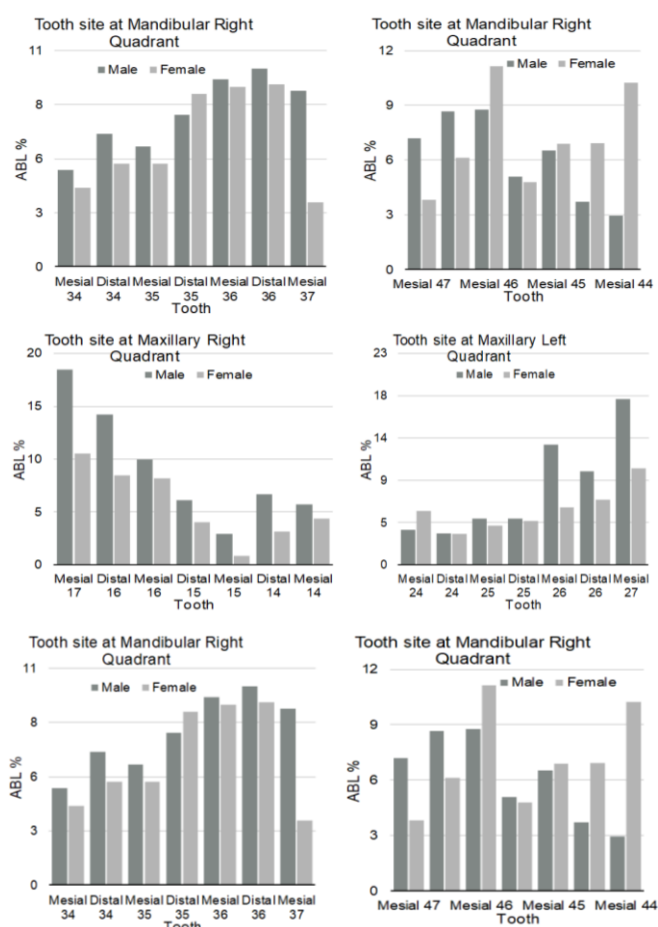

Figure 2. Summary of the percentage of alveolar bone loss of each tooth site in maxilla and mandible according to male and female.

	Number of sites (N)		Percentage of Vertical/Horizontal bone defect (%)	
	Male	Female	Male	Female
Mesial of Second Molar	2 6	2 1	88.5/11.5	47.6/52.4
Distal of First Molar	2 6	2 2	84.6/15.4	63.6/36.4
Mesial of First Molar	2 6	2 2	61.5/38.5	68.2/31.8
Distal of Second Premolar	2 6	2 1	34.6/65.4	28.6/71.4
Mesial of Second Premolar	2 6	2 1	30.8/69.2	19.0/81.0
Distal of First Premolar	2 6	2 2	34.6/65.4	13.6/86.4
Mesial of First Premolar	2 6	2 2	34.6/69.4	31.8/68.2

Table 1. Prevalence of vertical and horizontal bony defect of the maxillary teeth.

However, based on the inclusion criteria set, only 24 subjects were diagnosed and selected as true Aggressive Periodontitis. Therefore, the prevalence of patients diagnosed with Aggressive Periodontitis was 2.5%

comprising of 13 male patients and 11 female patients.

The percentage of ABL of each tooth site in maxilla and mandible was grouped and compared between each right and left quadrant according to male and female subjects (Figure 2.0). The mean ABL percentages of both male and female in each quadrant were statistically significant (p<0.05). Gradual increase of ABL percentages was demonstrated at the mesial of maxillary second molar for both right and left quadrant of male (right=18.50%, left=17.65%) and female (right=10.55%, left=10.24%). However, for mandibular tooth, there was gradual increase of ABL% at mesial of right mandibular first molar and distal of left mandibular first molar on both male (right=8.77%, left=10.08%) and female (right 11.13%, left=9.27%) subjects.

	Number of sites (N)		Percentage of Vertical/Horizontal bone defect (%)	
	Male	Female	Male	Female
Mesial of Second Molar	24	21	50.0/50.0	52.4/47.6
Distal of First Molar	23	19	52.2/47.8	47.4/52.6
Mesial of First Molar	23	20	52.2/47.8	40.0/60.0
Distal of Second Premolar	26	22	26.9/73.1	18.2/81.8
Mesial of Second Premolar	26	20	50.0/50.0	40.0/60.0
Distal of First Premolar	26	20	26.9/73.1	15.0/85.0
Mesial of First Premolar	26	20	30.8/69.2	25.0/75.0

Table 2. Prevalence of vertical and horizontal bony defect of the mandibular teeth.

Significant correlation was observed between ABL percentages on both right and left quadrant of maxilla, r=0.583 and mandible, r=0.794 in male which significant at (p<0.05). However, in female, there was weak positive correlation between right and left quadrant of maxilla and mandible with r=0.260 and r=0.408 respectively (p<0.05).

Discussion

The prevalence of AgP in this study was 2.5% which is slightly higher than that reported in the earlier studies. The higher figure is expected as it was conducted at the center of referral for periodontal disease, however the disease prevalence is relatively small compared to other type of periodontal disease referred to the center.

Aggressive Periodontitis (AgP) is a rare form of periodontal disease. There are limited epidemiological studies on the prevalence of AgP in Asian populations. Researches conducted in Turkey on 13- to 19-year-old schoolchildren in Ankara and on 15- to 18-year-old schoolchildren in Tehran, Iran, reported that the disease prevalence were 0.6% and 0.13%, respectively[25, 26]. Study examined panoramic radiographs of 18- to 19-year-old Israeli male military recruits and estimated the disease prevalence to be 0.86%[27]. Recent study carried out by Jamila et al. in a population of Moroccan school students reported that 4.9% had aggressive periodontitis[28]. However due to poor case definitions, selection criteria and disease detection method, estimation of the disease prevalence remains unreliable.

The difficulty in diagnosing AgP is shown in this study, out of 116 numbers of patients were previously diagnosed with AgP at this center, only 24 patients were truly diagnosed as having AgP following the criteria set based on the 1999 Periodontal Disease Classification[29]. Key diagnostic criteria of AgP include an early age of onset, involvement of multiple teeth with a distinctive pattern of periodontal attachment and bone loss, a relatively high rate of disease progression and absence of systemic diseases that compromise the host's response to infection[13]. Patient has familial aggregation, circumpubertal onset and usually diagnosed below 30 years old[13]. Patients that were initially diagnosed with AgP were excluded from the study due to age, medical condition i.e. diabetes and smoking status. This shows that the clinical distinction between chronic and aggressive periodontitis is a problem when it comes to diagnosing the disease. However, a clear-cut case definition is required for the classification purpose to elucidate the aetiology and pathogenesis of the disease. This problem has been reviewed by Smith et al[30] which found no apparent histopathological explanation to differentiate the two. It may well be that chronic and aggressive periodontitis are two similar diseases but different rate of progression[30]. This study was similar with what had been found in other studies, even though incisors were excluded due to overlapping images of the vertebrae, study showed that the common teeth affected were second and first molars. The percentage of the alveolar bone loss was quite high compared to the other tooth. The most

important feature of aggressive periodontitis is that the patient exhibits periodontal attachment loss at multiple teeth and tissue loss occur bilaterally[15]. Both parameters can be used as one of the tools in early detection of the disease.

Our results showed that both maxilla and mandible for male and female groups were mostly affected by vertical bone defect at the first and second molar only. Radiologically, the destruction of alveolar bone appeared as vertical bone loss in the molar region and as horizontal bone loss in the premolars area, besides appearing as bilateral symmetrical patterns of bone loss in the molar region. The disease can be assumed whether it is diagnosed in an early or advanced stage by the degree of the bone loss. At the terminal stage of the disease, the bone loss is no longer vertical in nature, but it assumes a horizontal shap[31,32]. The female group showed lower percentage than male in vertical defect of affected teeth. This might be due the faster progression of the disease in females compared to males. Available evidence from the literature suggests that, at the circumpubertal age, young females might be more predisposed than males, and this effect decreases with increasing age[33].

The most important feature of aggressive periodontitis is that the patient exhibits bilateral periodontal attachment loss at multiple teeth and the tissue loss[15]. It starts at the proximal surfaces of the permanents first molars and/or incisors; it often shows a vertical pattern of alveolar bone loss at the proximal surfaces of the permanent first molars radiographically[34]. It can be calculated as percentages and the value or amount of alveolar bone loss are varies depending on the severity of the destruction[11].

Panoromic x-ray (OPG) is widely used in dentistry[35]. The position of the bony crest enables the estimation of the degree of bone loss. The pattern of bone loss can be seen and was broadly described as horizontal or vertical. The location of any vertical (angular) defects can be identified. The limitations of the OPG is imposed by the film/screen/cassette combination, tomographic blur, superimposed soft tissue and 'ghost' shadows, the overlap of adjacent teeth and variations in magnification. The variability in the age of onset of aggressive periodontitis may be associated with the type and severity of etiologic factors. Hence, early age of onset may suggest a higher potency or high level of etiological factors than late-onset disease. At present, the diagnosis of aggressive periodontitis is achieved using case history, clinical examination and radiographic evaluation.

Assessment methods that generate smaller measurement errors may contribute to an earlier detection of cases of aggressive periodontitis before significant tissue loss occurs. Therefore, introduction to specific criteria in determined the presence of the disease from the interpretation of the radiographic investigation of the OPG would help in confirming the diagnosis. These include the behavior of the AgP that usually affect molar with vertical bony defects and occurred bilaterally. It helps in early detection of the disease.

Epidemiological study should be done for AgP in Malaysia, as there is an increase of the periodontal disease among the adolescent. Other than it may be caused by a sedentary lifestyle, the emerging of the AgP itself may also cause it, as periodontitis is a silent epidemic disease

Conclusions

The amount and architecture of the alveolar bone loss in patient diagnosed with Aggressive Periodontitis at Faculty of Dentistry, UiTM Shah Alam showed similar features with the published literature. The tooth mainly affected was the first and second molar. There were slight differences between the amount of bone loss in male and female, and radiographically, the pattern of the alveolar bone loss occurred bilaterally giving a symmetrical image. As for type of bony defects, molars were presented more with vertical bony defects compared to premolars that showed more horizontal defects. Further studies with increase samples are needed to be conducted to describe the characteristic of this rare form of periodontal disease.

Acknowledgements

Declaration of Interest

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