Prevalence and Risk Factors for Clinical Attachment Loss in Adult Yemenis: A Community-Based Study in the City of Dhamar

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Abstract: This paper is aimed to estimate the prevalence and extent of periodontal clinical attachment loss and the possible related risk factors in adult Yemeni population. The study sample composed of 884 adult subjects (496 males and 388 females) aged ≥ 25 years old. Clinical examination of CAL was performed on six sites for each tooth. Prevalence and severity of CAL and the relationship with the risk variables were assessed. Chi-squared and multiple regression tests were used with significant level of \( P < 0.05 \). Out of the 884 subjects examined, 629 (71.2\%) had CAL ≥ 1 mm [233 (26.4\%) had CAL ≥ 1 and < 3 mm, 214 (24.2\%) had CAL ≥ 3 and < 5 mm, and 182 (20.6\%) had CAL ≥ 5 mm]. Age, gender, tooth brushing, Khat chewing, smoking, plaque deposits, and calculus accumulation were associated significantly with CAL (\( P < 0.05 \)). In this study population, a high prevalence of CAL ≥ 5 mm was observed. Bad habits and poor oral hygiene showed strong association with the periodontal clinical attachment loss.

Keywords: Periodontal Attachment Loss, Risk Factors, Yemenis, Periodontitis

1. Introduction

Periodontitis is a chronic inflammatory disease of the supporting tissues around the teeth caused by dental plaque infection which is considered the major etiologic factor in pathogenesis of periodontitis. The bacteria in subgingival biofilms, with numerous other species, embed and extend apically leading to host-immune response to the bacterial plaque infection which has been implicated as a key factor in determining the extent and severity of periodontitis [1, 2]. As a result of an immune reaction, there will be a production of cytokines array and other inflammatory mediators which cause tissue damage resulting in periodontal pockets formation, destruction of the alveolar bone and attachment loss [2]. The severity of periodontal diseases, which varies over time, depends on the quantity and quality of the biofilm and the presence of modifying factors which affect the permanence of plaque [3]. Clinical Attachment Loss (CAL) is one of the important clinical parameters which provide an indication of the degree of remaining tooth support. It occurs through the destruction of the periodontal ligament and its adjacent alveolar bone leading subsequently to gingival recession and pathologic periodontal probing depth. Therefore, the severity of periodontal disease can be estimated by the degree of CAL [4-6]. The clinical diagnosis of periodontitis is based on the measurement of presence and extent of periodontal pockets, loss of clinical attachment, pattern and extent of alveolar bone loss, or a combination of these means [7]. The measurement of CAL can be obtained by measuring the distance from the cemento-enamel junction (CEJ) down to the lowest point at the bottom of the pathological periodontal pocket using a graduated periodontal probe (CEJ) down to the lowest point at the bottom of the pathological periodontal pocket using a graduated periodontal probe (CEJ). Although periodontal disease primarily occurs due to dental biofilms infection, it may be attributed to other risk factors such
Participants were informed about the aim of the study and a period from November 2014 to April 2015. The study sample comprised 884 adult subjects (496 males and 388 females) aged ≥25 years old. The study was approved by Research and Ethics Committee, Faculty of Dentistry, University of Thamarr. All participants were informed about the aim of the study and a signed informed consent was obtained. To avoid confounding factors, the following exclusion criteria were applied: 1) Systemic diseases (e.g.: diabetes mellitus, organs transplantation, and hypertension), 2) Malignant tumors including oral cavity cancer, 3) Wearing removable or fixed prosthesis or orthodontic appliance, 4) Edentulousness (full missing of teeth), and 5) Pregnant women. Data was collected by interview and clinical examination.

1). Interview: The data were recorded in a special questionnaire designed to include the important information that would help to detect the correlation between clinical attachment loss (CAL) and some risk factors as age, gender, plaque accumulation, calculus deposits, as well as tooth brushing, smoking, and khat chewing habits.

2). Clinical examination: The clinical examination was carried out by the one author (Amran AG). All permanent fully erupted teeth, excluding the third molars, were examined. Plaque index, calculus index, pocket depth, and gingival recession, were measured by using a dental mirror, dental explorer and 0.4 mm periodontal probe (Hu-friedy’s WHO-style probe, Hu-Friedy Inc, Chicago, IL, USA). Number of the missing teeth was counted as well as the clinical attachment loss was calculated.

Dental plaque was measured on a scale of (0-3) [13] while, the amount of calculus deposits was assessed by the Calculus Surface Index (CSI) [14]. Pocket depth and gingival recession were measured at six sites per tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual) using the periodontal probe. Pocket depth was measured from the gingival margin to the lowest point at the base of the periodontal pocket while, the gingival recession was evaluated by measuring the distance from CEJ to the bottom of the periodontal pocket. Clinical attachment loss was measured in cases of exposure of (CEJ) by the distance from CEJ to base of the gingival sulcus. The level of CEJ was determined by tactile perception with the tip of the periodontal probe. In cases on which the (CEJ) was covered by calculus, hidden by a restoration or possibly lost due to wear or carious lesions. Accordingly, the location of such junction was estimated on the basis of the adjacent teeth [15]. Measurements of CAL were rounded off to the nearest millimeter. The mean value of the CAL was recorded and divided into 4 groups: CAL <1 mm (considered as normal group), CAL ≥1 and < 3 mm (mild group), CAL ≥3 and < 5 mm (moderate group), and CAL ≥5 mm (severe group). According to age, the participants were divided into five groups: 25-34 years, 35-44 years, 45-54 years, 55-64 years, and ≥ 65 years (Table 1).

Statistical analysis

Statistical analysis was performed using the risk factors as independent variables and CAL as a dependent variable. Significance of frequency of the risk factors among the participants was calculated using Chi-squared test. The categorical variables were expressed by proportions while the continuous variables were expressed as means. Multiple regression analysis was used to estimate the odds ratio of the independent variables associated with CAL. A P-value of 0.05 was considered significant.

3. Result

The descriptive data of the study population are summarized in Table 1. The study sample consisted of (884) participants with mean age (38.13±11.75) ranged from 25 to 75 years. Males were 496 (56.1%) with mean age (39.06±12.42) years while, 388 (43.9%) were females with mean age (36.95±10.77) years. Out of the examined subjects, 255 (28.8%) had CAL < 1 mm (normal group) and 657 (71.2%) had CAL ≥ 1 mm (effected group) which was, according to the severity, categorized into three groups: 233 (26.4%) participants had CAL ≥ 1 and < 3 mm belongs to the mild group, 214 (24.2%) participants had CAL ≥ 3 and < 5 mm belongs to the moderate group, and 182 (20.6%) participants had CAL ≥ 5 mm belongs to the severe group.

Frequencies of the different levels of CAL associated with risk factors are summarized in Table 2. Findings of this study showed that the severity of CAL was increased with age progress with significant difference (P < 0.05). Of the age group 25-34 years there were 47.9% subjects who had normal CAL (1 < mm) while only 3.2% of the age group ≥ 65 years was found with normal CAL. The relationship between the severity of CAL and the old ages as a risk factor was highly significant (P = 0.000, OR = 1.27) (Table 3).

Severity of attachment loss was observed more in males than in females with significant different (P < 0.05). Furthermore, the relationship between gender and CAL was significant (P = 0.03, OR = 0.79).

Subjects who reported tooth brushing were much less than...
who did not use brushing (243 compared to 641). This directly reflected on their periodontal status as individuals who brushed their teeth were less affected with moderate and severe CAL (8.2%, 2.5%) than those who did not (30.3%, 27.5%) respectively with significant difference (P < 0.05). The relationship between tooth brushing with CAL occurrence and severity was significant (P = 0.001, OR = 0.80).

Out of the study sample 25.8% reported smoking while, 74.2% were non-smokers. Normal CAL was observed more among non-smokers than smokers (36%, 3.8%) respectively with significant difference (P < 0.05). Association between smoking with CAL severity was significant (P = 0.02, OR = 1.17).

Khat chewing was reported from 530 (60%) respondents while, 354 (40%) were non-khat chewers. Loss of attachment was higher among khat chewer than non-khat chewers in all CAL levels (mild, moderate, and severe) with significant difference (P < 0.05). Association between khat chewing and CAL development and severity was found (P = 0.000, OR = 1.86) respectively (Table 3).

For plaque accumulation, the findings of the study found significant increasing in mean of plaque index with increasing severity of CAL. The mean of plaque was (1.28±0.36) in normal subjects while, it ranged from 1.7 to 2.23 among affected subjects. Dental calculus was observed on 460 (52%) subjects. Severity of CAL was significantly increased with the presence of calculus (Table 2). Significant relationship between khat chewing and CAL development and severity was found (P = 0.02, OR = 1.17).

One of the main objectives of this study was to assess the role of teeth missing as a possible risk factor for attachment loss. The current study showed 30% of the study subjects had missed one or more of their teeth (Table 1). Furthermore, it was observed that the mean of the missing teeth was increased gradually among participants from normal basing through mild and moderate to the severe level of CAL (0.05±0.64, 0.6±1.43, 1.47±2.28, 4.18±4.07) respectively (Table 2). Moreover, significant relationship between teeth missing with CAL (P = 0.000, OR = 1.04) (Table 3).

4. Discussion

The primary objectives in the present cross-sectional study were undertaken to assess the prevalence of clinical attachment loss and to determine some of the various risk factors of CAL in Yemeni adult population. The mild and moderate CAL in the present study were observed among 50.6% of the study population. These results were lower than those observed in previous studies conducted in South India (96.4% had CAL < 5 mm) [16], Korean (80.27% had CAL < 5 mm) [17], USA (32.7% had CAL < 5 mm) [18], French (80.3% had CAL < 5 mm) [19], and Germany (89.7% had CAL < 5 mm) [20], while the severe CAL was higher than those observed in the same above-mentioned studies.

High severity of CAL among Yemeni population might be related to the lower socioeconomic level and some social habits as Khat chewing. The various geographic regions which could be attributed to cultural traits, socioeconomic conditions, and habits of the target population might explain the variations of CAL prevalence in different populations worldwide [16].

In the present study, statistically significant relationship was observed between the risk factors evaluated with the mean of CAL. As illustrated in Table 2, increasing in prevalence and severity of CAL were accompanying with increasing in age. This result was similar to some of previous studies [17, 21, 22]. Furthermore, the relationship between the severity of CAL with age was highly significant (P = 0.000, OR = 1.27). It has been documented that poorer oral hygiene with increasing age is related to an increase of exposure time to causative diseases and an increase in aging-related factors [24]. The findings of this study showed that males who had CAL > 5 mm were significantly higher than females. This result agreed with the results of some previous studies indicating that males were more strongly a risk factor for clinical attachment loss than females (80.3% had CAL < 5 mm) [19], and Germany (89.7% had CAL < 5 mm) [17], U.S.A (32.7% had CAL < 5 mm) [18], French (80.3% had CAL < 5 mm) [19], and Germany (89.7% had CAL < 5 mm) [20], while the severe CAL was higher than those observed in the same above-mentioned studies.

Table 1. Characteristics and clinical records of all subjects.

| Variable            | Group | Number (%) |
|---------------------|-------|------------|
| Variable            | Group | Number (%) |
| Age                 | 25 - 34 yrs | 405 (45.8) |
|                     | 35 - 44 yrs | 236 (26.7) |
|                     | 45 - 54 yrs | 134 (15.2) |
|                     | 55 - 64 yrs | 78 (8.8) |
| Gender              | Male | 496 (56.1) |
|                     | Female | 388 (43.9) |
| Brushing            | No | 641 (72.5) |
|                     | Yes | 243 (27.5) |
| Smoking             | No | 656 (74.2) |
|                     | Yes | 228 (25.8) |
| Khat chewing        | No | 354 (40) |
|                     | Yes | 330 (60) |
| Missing Teeth       | No | 617 (70) |
|                     | Yes | 267 (30) |
| Calculus Index      | Not present | 424 (48) |
|                     | Present | 460 (52) |
|                      | < 1 mm | 255 (28.8) |
|                      | ≥ 1 CAL < 3 mm | 233 (26.4) |
|                      | ≥ 3 CAL < 5 mm | 214 (24.2) |
|                      | ≥ 5 mm | 182 (20.6) |
Among the participants in this study who reported smoking, 31.6% had moderate CAL and 36% had severe CAL while, non-smokers who had moderate and severe CAL were 21.6% and 15.2% respectively. Smokers are 1.17 times likely to have loss of attachment than non-smokers. These findings are in accordance with the results of previous studies [30, 31]. Numerous epidemiologic studies reported that smoking is a major risk factor for periodontal disease [32]. Furthermore, other previous study has indicated that, smoking is closely related to CAL [17]. This might be related to the major role of smoking in development and provoking of periodontitis by affecting host immune responses [33].

Statistically significant increasing in severity of CAL was observed among Khat chewers than non-Khat chewers. Severity of CAL was 1.14 times more among Khat chewers. The habit of khat chewing is widely spread among Yemeni population. Khat (Qat) plant (Catha edulis) is a tree belongs to family Celastraceous frequently cultivated in certain areas of East Africa and the Arabian Peninsula [34]. The findings of the current study are similar with previous studies reported that high rate of periodontal diseases have been observed among male Yemeni khat chewers [35, 36]. In contrast, some reports [37, 38] demonstrated that khat chewing was associated with CAL but not pocket depth. Khat chewing appeared to be the most etiological factors causing the gingival recession resulting in CAL among Yemeni population [39]. Furthermore, Al-sharaby et al. [40], in a study conducted on Yemeni adult males, reported that heavy long-time khat chewing is probably an independent risk factor of clinical attachment loss.

| Variables | Clinical Attachment Loss | Total | P value |
|-----------|--------------------------|-------|---------|
|          | Normal | Mild | Moderate | Severe | < 1 mm | ≤ CAL < 3 mm | ≥5 mm | < 1 mm | ≤ CAL < 3 mm | ≥5 mm |
| Age 25 - 34 yrs | 194 (47.9) | 122 (30.1) | 62 (15.3) | 27 (6.7) | 405 (45.8) | <.0001 |
| Age 35 - 44 yrs | 49 (20.8) | 73 (30.9) | 69 (29.2) | 45 (19.1) | 236 (26.7) | <.0001 |
| Age 45 - 54 yrs | 10 (7.5) | 31 (23.1) | 57 (42.5) | 36 (26.9) | 134 (15.2) | <.0001 |
| Age 55 - 64 yrs | 1 (1.3) | 4 (5.1) | 19 (24.4) | 54 (69.2) | 78 (8.8) | <.0001 |
| ≥ 65 yrs | 1 (3.2) | 3 (9.7) | 20 (64.5) | 31 (3.5) | 81 (18.8) | <.0001 |
| Gender Male | 116 (23.4) | 137 (27.6) | 120 (24.2) | 123 (24.8) | 496 (56.1) | <.0001 |
| Gender Female | 139 (35.8) | 96 (24.7) | 94 (24.2) | 59 (15.2) | 388 (43.9) | <.0001 |
| Brushing No | 102 (15.9) | 169 (26.4) | 194 (30.3) | 176 (27.5) | 641 (72.5) | <.0001 |
| Brushing Yes | 153 (63) | 64 (26.3) | 20 (8.2) | 6 (2.5) | 243 (27.5) | <.0001 |
| Smoking No | 236 (36) | 178 (27.1) | 142 (21.6) | 100 (15.2) | 656 (74.2) | <.0001 |
| Smoking Yes | 19 (8.3) | 55 (24.1) | 72 (31.6) | 82 (36) | 228 (25.8) | <.0001 |
| Khat chewing No | 163 (46) | 82 (23.2) | 68 (19.2) | 41 (11.6) | 354 (40) | <.0001 |
| Khat chewing Yes | 92 (17.4) | 151 (28.5) | 146 (27.5) | 141 (26.6) | 530 (60) | <.0001 |
| Calculus Not present | 238 (56.1) | 124 (29.2) | 51 (12) | 11 (2.6) | 424 (48) | <.0001 |
| Calculus Present | 17 (3.7) | 109 (23.7) | 163 (35.4) | 171 (37.2) | 460 (52) | <.0001 |
| Missing Teeth (1.39±2.75) | (0.05±0.64) | (0.6±1.43) | (1.47±2.28) | (4.18±4.07) | (0.05±0.64) | <.0001 |
| Plaque Index (1.746±0.51) | (1.28±0.36) | (1.7±0.37) | (1.95±0.40) | (2.23±0.38) | (1.28±0.36) | <.0001 |

Table 3. Multiple regression analysis with adjusted odds ratio.
Plaque and calculus deposits were significantly associated with the severity of CAL. Subjects with plaque and calculus were 1.82 and 1.86 times respectively more likely to develop periodontal loss of attachment. These results are in accordance with the findings of Suresh Ranga Rao [16], López et al. [27], and De Souza and Taba [28] which reported that poor oral hygiene had a significant association with CAL severity. Plaque accumulation results in passage of bacteria and their products through the non-keratinized junctional epithelium leading to series of host responses that result in pocket formation and clinical attachment loss [41]. The result of this study showed that the mean of missing teeth was significantly higher among subjects who had moderate and severe CAL than individuals who had mild CAL. The odds of CAL severity among subjects who have missing teeth were 1.04 times higher than the odds of CAL severity among subjects with no missing teeth. Numerous previous studies indicated that progression of periodontitis to the severe condition resulting in tooth loss by the destruction of tooth supporting tissues and loss of attachment [42, 43]. On the other hand, edentulous area without restoration for long time may lead to gingival recession and CAL on the adjacent teeth by continuous application of forces on that area during mastication. Moreover, non-tooth-supported removable partial dentures have adversely effects on the periodontium [44-46].

5. Conclusion

Within the limitations of this study it can be concluded that, a high prevalence of severe clinical attachment loss among adult Yemeni population. All risk factors mentioned in this study were strongly associated with the prevalence, extent, and severity of the periodontal attachment loss. Further studies with larger sample including adolescents and adult Yemeni population in different geographic areas are recommended.

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