Original Article

Non surgical management of periodontitis related halitosis among adults

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ABSTRACT

Introduction: Management of periodontitis-related oral malodor may include simple measures such as scaling and root planning (SRP) and oral hygiene instructions. **Aim:** A prospective cross-sectional study was conducted to evaluate the effect of non-surgical management of periodontitis on controlling halitosis (oral malodor) measured by Halimeter. **Methodology:** Clinical data were recorded from 60 participants who were attended the out-patient periodontics clinic at the College of Dentistry of King Khalid University, Abha city, Saudi Arabia. The participants were grouped as periodontitis (case), non-surgically treated periodontitis and healthy (control). Volatile sulfur compounds were measured in parts per billion (ppb) as a caliber for halitosis for each group using a Halimeter®. Data were statistically analyzed utilizing the Chi-square distribution test ($P < 0.05$). **Results:** In the average, case group showed strong halitosis 230.00 ± 54.29 ppb that was reduced to weak halitosis 124.25 ± 26.43 ppb following non-surgical (SRP) management of chronic periodontitis, with the deeper pockets, increased halitosis was measured as mean halitosis of periodontitis and treated cases 188.90 ± 14.22 ppb and 114.70 ± 20.75 ppb, 240.25 ± 58.08 ppb and 128.25 ± 39.31 ppb and 294.33 ± 19.64 ppb and 137.50 ± 23.36 ppb, respectively, in 5-6, 6.1-7 and 7.1-8 mm groups respectively. **Conclusion:** Based on study results, halitosis is directly related to periodontitis and periodontal pocket depth among the adults, which can be successfully controlled by SRP.

Key words: Halimeter®, halitosis, non-surgical therapy, periodontitis

INTRODUCTION

Halitosis can be referred to as bad or foul breath, breath malodor, oral malodor, and fetor oris. Halitosis is often caused by periodontal diseases and/or tongue coating and patients with periodontitis were at higher risk for halitosis detection than healthy individuals.[1-3] Halitosis associated with periodontitis negatively affected quality-of-life among Japanese population.[4] Conventional non-surgical periodontal therapy has a potential to ameliorate patient perceptions of oral health. Halitosis is considered the third reason, after caries and periodontal disease, for patients to seek dental care.[5] The prevalence of halitosis in the general population was reported to a range from 23% to 50%, respectively.[6] On an average, 80-90% of subjects suffering from halitosis, the condition was attributed to oral factors, hence the term oral malodor.[7,8]

Several factors play a role in oral halitosis including periodontal diseases, tongue coating, peri-implant diseases, deep carious lesions, exposed necrotic tooth pulp, pericoronitis, mucosal ulcerations, healing wounds, impacted food or debris, unclean dentures, and factors causing decrease salivary flow rate.[9,10] Halitosis arises from microbial degradation of organic substrates present in saliva, gingival crevicular fluids, oral soft-tissues, and retained debris, or may originate from the bacterial metabolism on the tongue dorsum, and in the periodontal pockets.[11-13]

Anaerobic bacteria such as *Porphyromonas gingivalis* (*P.g.*), *Treponema denticola* (*T.d.*) and *Tannrella forsythia* (*T.f.*) or bacteria that live normally within the surface of the tongue and deep periodontal pockets, reproduce in places without oxygen, digest proteins found in food, dead cells, blood and mucous. Proteins that contain amino acids, such as cysteine and methionine are rich in sulfur.[15-17] Volatile sulfur compounds (VSCs) are frequently encountered in the exhaled air and ultimately make breath smell like rotten eggs or dirty socks with feeling embarrassed. In over 85% of halitosis

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cases, the cause of the bad breath was the result of poor oral hygiene, 43% was found on tongue coating, 11% from gingivitis and/or periodontitis and 18% originated from the combination of the two. Pseudo-halitosis or halitophobia were diagnosed in 16% of the cases.[16,17] This degradation lead to produce of VSCs, particularly hydrogen sulfide (H_2S), methyl mercaptan (CH_3SH), and dimethyl sulfide [$(CH_3)_2S$].[13,14] H_2S and CH_3SH mainly contributed to intra oral halitosis, while $(CH_3)_2S$ was mainly found in extra-oral halitosis.[18] It has been reported that the VSCs level in mouth breath of patients with periodontal disease was found 8-times greater than that of the control patients.[19] Halitosis can be a mirror reflection of systemic diseases such as the upper and lower respiratory tract infections, metabolic diseases, medications, carcinoma, and other systemic diseases such as diabetes mellitus that gives rise to ketone bodies (ketoacidosis) in the breath.[20,21]

In the past, it was difficult to measure halitosis. Recently, halitosis is measurable by the aid of Halimeter® device.[22] The Halimeter® is a gas analysis machine designed to measure the amount of sulfur bonds in a volume of gas. With the Halimeter®, it is possible to directly measure the quantitative amounts of offending VSCs present in parts per billion (ppb).[22] The normal range of normal breath ranging from 80 to 160 ppb, the bad breath is expected upon Halimeter® readings exceeded 160 ppb. Many trials had been done to control and manage oral malodor as treatment with the antibiotic rinse, which had a positive change in the periodontal status and breath odor of these patients. These data indicate that there is a considerable advantage to the use of topical antibiotic rinses. A substantial decrease in both halitosis and periodontal disease markers can be achieved without the risk of the systemic effects of an oral antibiotic.[22,23] This advancement in measuring and controlling halitosis encouraged us to conduct this study to investigate the effect of non-surgical management on controlling periodontitis-related halitosis among adults.

METHODOLOGY

Individuals recruited for this study were selected from the outpatient periodontics clinics of the College of Dentistry at King Khalid University, Abha city of Saudi Arabia. Written consents of the periodontitis patients were obtained on the forms that complied with the approved ethical form of the college ethical committee. Individuals aged 31.35 ± 3.25 (25-35) years, selected for this study were free from any systemic diseases or intra oral causes that may affect the oral breath negatively except periodontitis. Patients taken antibiotics within last 6 weeks were also excluded. 60 adult participants equally distributed according to gender, were selected for this study, and divided into three groups where each group contained 20 participants (10 males and 10 females):

- Group I: Patients with chronic periodontitis, probing pocket depth (PPD) ≥5 mm, as case group
- Group II: Patients of Group II were measured the halitosis following 2 weeks of non-surgical periodontal therapy i.e., thorough scaling and root planning (SRP)
- Group III: Individuals free from any oral diseases, as a control group.

Halitosis values were divided into four categories and classified as: Normal (values from 0 to 100 ppb), weak (101-150 ppb), strong (151-300 ppb), or very strong (>300 ppb).[22] Each participant kept the mouth closed for 60 s before sampling. A plastic straw was inserted and positioned above the posterior portion of tongue dorsum, not touching the oral mucosa or the tongue. Breathing was not allowed during sampling. The mouth was kept open by approximately 1.5 cm, and the peak value was recorded. The measurements were duplicated, and the mean value was calculated.

The following periodontal indices were used on periodontally affected and control individuals at four sites: Mesiobuccal, midbuccal, distobuccal and midpalatal (midlingual). The plaque index, a modification of Silness and Loe,[24] was scored as:

- 0 = No plaque was detected on the gingival or crown margin or the area in between
- 1 = Plaque was visible following probing of either gingival margin of the crown or gingival area of the tooth
- 2 = Plaque was visible on a portion of both gingival and crown margins without the need to probing
- 3 = Plaque was visibly continuous on both gingival or crown margins and/or calculus was visible.

The gingival index by Loe and Silness[25] was modified and used to evaluate the degree of gingival inflammation on the abutment teeth at the defined sites as follows:

- 0 = Absence of inflammation
- 1 = Mild inflammation of the gingiva; slight change in color, slight edema and no bleeding
- 2 = Moderate inflammation of the gingiva; redness, edema and glazed appearance and bleeding on probing
- 3 = Severe inflammation of the gingiva; marked redness, edema and tendency to spontaneous bleeding.

PPD was measured as described by Ramfjord[26] from the free gingival crest to the level of attachment of the periodontium at the four previously mentioned sites. All the measurements were made with calibrated probes graduated in millimeters (University of Michigan "O" probe with William's markings; Hu-Friedy, Chicago, USA) under a standard dental light with patient seated in a semi-supine position in a standard dental chair.

Statistical analysis

Statistical analysis was performed with the IBM mainframe version of Statistical Analysis System, a powerful, time sharing and automatized method of a comprehensive data analysis, utilizing the Chi-square test *P* value for the

effect of demographic characteristics (sex, educational background, location) and the significance value was set at <0.05.

RESULTS

Figure 1 shows the presence of average halitosis among the study groups. Patients having periodontitis (case) had halitosis 230.00 ± 54.29 ppb and 102.35 ± 21.35 ppb in patients without periodontitis (control). Whereas, patients received non-surgical therapy for periodontitis, i.e. SRP showed improvement of halitosis condition (124.25 ± 26.43 ppb).

Figure 2 presents the data of average halitosis conditions among the male and female participants. Male participants in case group showed halitosis 240.38 ± 52.89 ppb that was higher (213.00 ± 56.30 ppb) than the female case group. In the control groups, male participants had a little higher halitosis (103.55 ± 24.23 ppb) than the female participants (100.89 ± 18.56 ppb). The halitosis conditions among the periodontitis-treated groups showed nearly the same in males and females 124.43 ± 19.97 ppb and 124.15 ± 30.11 ppb, respectively.

Figure 3 shows the average PPD 6.58 ± 1.03 mm among all periodontitis patients in which average PPD among males and females were 6.69 ± 1.03 mm and 6.36 ± 1.07 mm, respectively.

Figure 4 shows the relationship of all study parameters among periodontitis and periodontitis-treated groups. In 5-6 mm PPD group [Figure 4a], mean halitosis of periodontitis and treated cases showed halitosis 188.90 ± 14.22 ppb and 114.70 ± 20.75 ppb, respectively. Among male and female case groups had halitosis 193.17 ± 14.76 ppb and 182.50 ± 12.34 ppb, respectively, whereas, in the treated cases, halitosis 110.83 ± 20.80 ppb and 120.50 ± 22.28 ppb were evident in males and female patients, respectively. As shown in Figure 4b (6.1-7 mm PPD group), mean halitosis of periodontitis and treated cases were found 240.25 ± 58.08 ppb and 128.25 ± 39.31 ppb, respectively. Halitosis conditions among male and female periodontitis patients and treated cases were higher than 5-6 mm PPD group with values of 260.33 ± 51.38 ppb and 180.00 ± 00.00 ppb; 134.33 ± 45.79 ppb and 110.00 ± 00.00 ppb, respectively. In 7.1-8 mm PPD group [Figure 4c], halitosis conditions in average of periodontitis and treated cases were found 294.33 ± 19.64 ppb and 137.50 ± 23.36 ppb, respectively. Among males and females in both periodontitis and treated cases, halitosis were found highest among all PPD groups and that were 296.25 ± 6.95 ppb and 290.50 ± 41.72 ppb, but readings of treated cases were 136.50 ± 29.08 ppb and 139.50 ± 13.44 ppb, respectively.

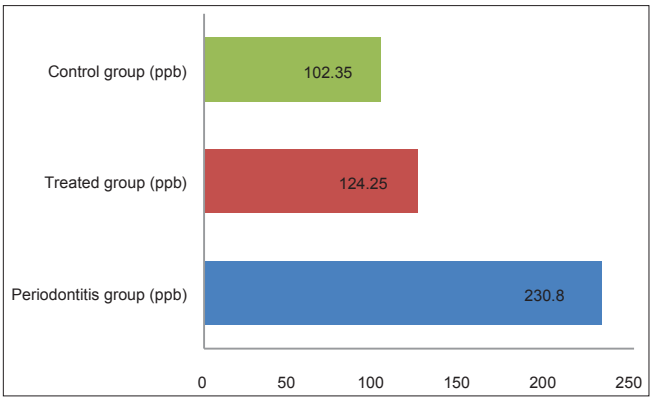

Figure 1: Case-control groups halitosis (ppb). Ppb-Parts per billion

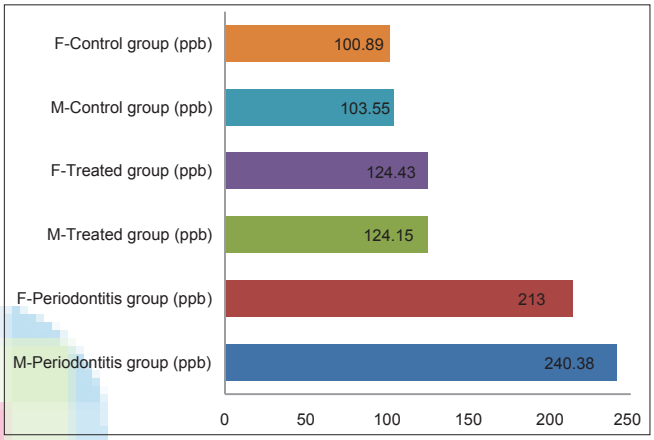

Figure 2: Gender-wise case-control groups halitosis (ppb). M-Male, F-Female, ppb-Parts per billion

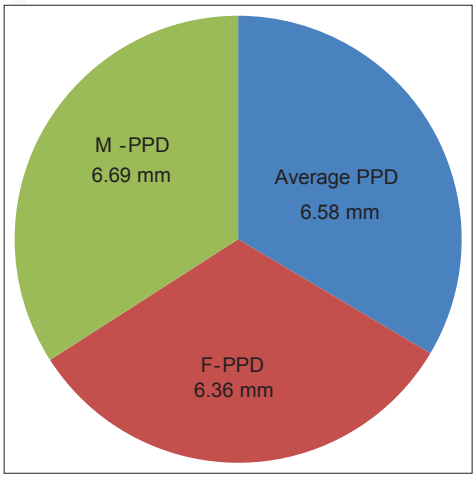

Figure 3: Average and gender-wise pocket depth (PPD). M-Male, F-Female, PPD-Probing pocket depth

DISCUSSION

The inflammation of gingival and periodontal tissues creates typical sources for oral malodors and plaque-related periodontal disease can increase the severity of halitosis.[4,27-29] However, the other forms of periodontal disease, especially

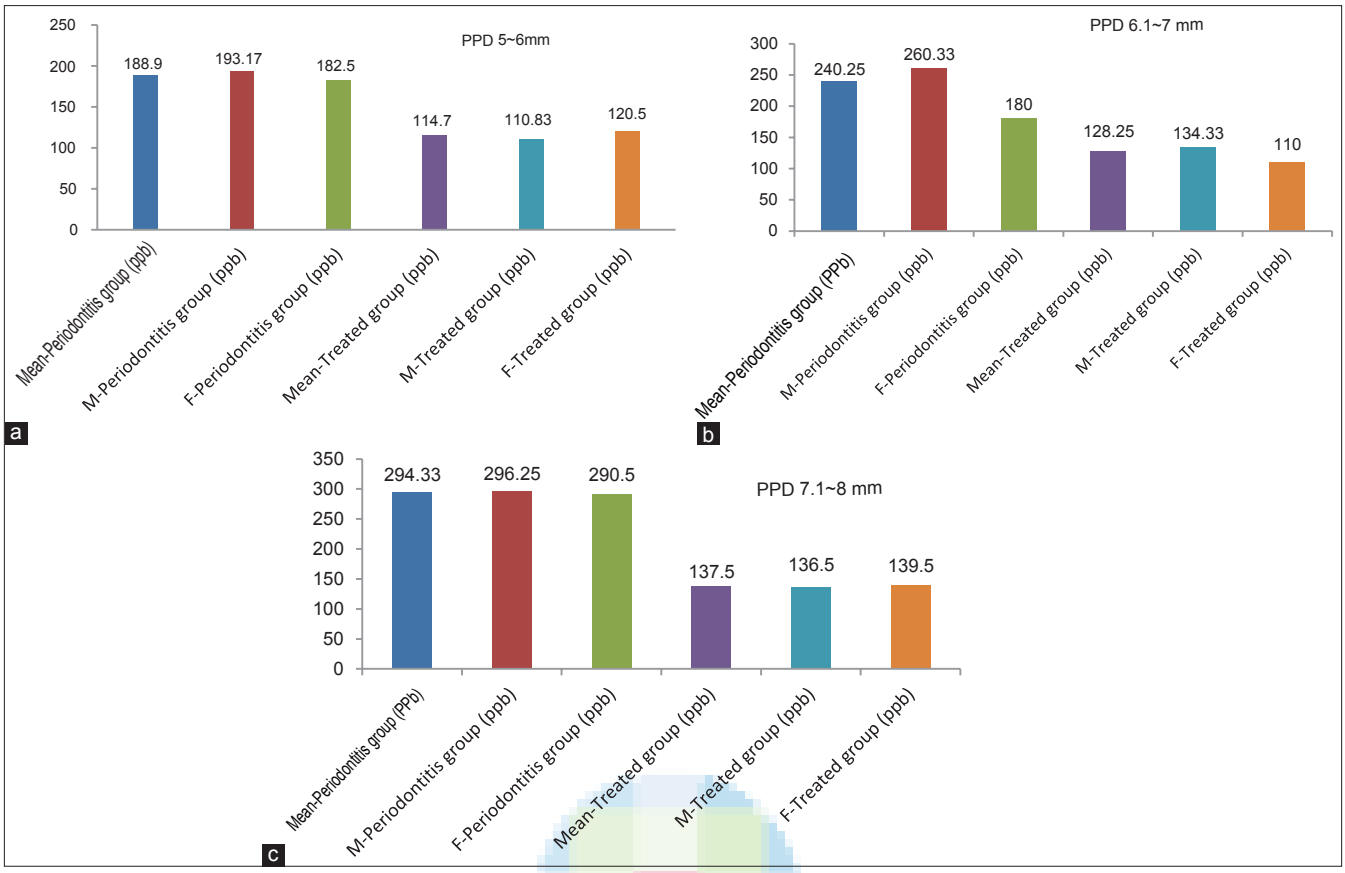

Figure 4: (a) Is presenting the gender-wise relationship of PPD and halitosis conditions among periodontitis and periodontitis-treated groups. In 5~6 mm PPD group, (b) (6.1~7 mm PPD group), mean halitosis of periodontitis and treated cases, (c) halitosis conditions in average of periodontitis and treated cases. M-Male, F-Female, PPD-Probing pocket depth, ppb-Parts per Billion

acute and aggressive forms such as acute necrotizing ulcerative gingivitis, pericoronitis, Vincent's disease or aggressive forms of periodontitis, can increase unpleasant breath odor.[4] Subjects with periodontitis reported substantial functional, physical, psychological, and social oral health-related quality of life impacts.[29] Halitosis or bad breath is frequently associated with chronic periodontitis which has health and social implications, which may lead to a significant social or psychological handicap.[2] Different conditions have been implicated, such as, periodontal pockets, stomatitis, rhinitis, pharyngitis and local factors, e.g. lack of self-clearing agents, smoking and food debris.[1-3] This study was performed with the participants having ≥5 mm PPD. Halitosis is a common feature of periodontitis in spite of age and genders[1-4,8] and that was clearly evident in this study. Periodontitis is related to increased pocket depth (PPD > 3 mm).[23-25] The case study group had average PPD 6.58 ± 1.03 mm. The progression of periodontitis was also related to the range of PPD. Study results showed the evidences of PPD ranges where the patients having deeper PPD had more halitosis conditions. Anaerobic bacteria (e.g. *P.g.*, *T.d.* and *T.f.*) that live normally in the deep periodontal pockets, digest proteins (e.g. cysteine and methionine) found in food, dead cells, blood and mucous, that are rich in sulfur to produce VSCs.[15-17] Strong halitosis were evident with the pocket deepening that expressed presence of increased numbers of such bacteria that produced VSCs. Halitosis can be a mirror reflection of systemic diseases such as the upper and lower respiratory tract infections, metabolic diseases, medications, carcinoma, and other systemic diseases such as diabetes mellitus that gives rise to ketone bodies in the breath.[20,21,29] All participants were selected for this study who were free from any systemic diseases even not taken antibiotics within the last 6 weeks nor received any sorts of periodontal therapies. Therefore, the research was conducted solely with the patients who were suffering from periodontitis. The case group received non-surgical therapy (SRP) at their initial visits and measured halitosis after 2 weeks. The present study may also prove that the management of periodontitis by non-surgical therapy (SRP) could reduce the strong halitosis (230.00 ± 54.29 ppb) to weak halitosis (124.25 ± 26.43 ppb) conditions even may lead to normal conditions (3 cases had <100 ppb after SRP). The results of this study supports that the oral microflora specially anaerobic periodontopathic bacteria which is a source of production of VSCs can be reduced in the short-term with conservative therapy as SRP with the positive effect on decreasing oral malodor intensity in periodontitis patients.

CONCLUSION

Based on study results halitosis is directly related to periodontitis and periodontal pocket depth among the adults, which can be successfully controlled by simple procedures such as SRP besides, instructions for oral hygiene.

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