2. PREVIOUS STUDY ON PERIODONTAL PROBLEMS

2.1. PERIODONTAL DISEASE

2.1.1 Definition

An inflammatory disease of the supporting tissues of the teeth caused by specific microorganism or group of specific microorganism, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession or both (Carranza, 2002).

2.1.2 Signs and symptoms

Healthy gums have coral pink color. Gum line hugs teeth tightly with no bleeding. In gingivitis, gums bleed easily when brushed or when probed gently during examination. Gums are inflamed and sensitive to touch, possibly producing bad breath, bad taste and appearing bluish-red in colour between the teeth.

In Early Periodontitis, gums may begin to pull away from the teeth. Bleeding, puffiness and inflammation becomes more pronounced giving bad breath and bad taste. Slight loss of bone can be seen horizontally on X-ray. Pockets of 3-4mm between teeth and gums are also seen in one or more areas of the mouth.

In Moderate Periodontitis, gum boils or abscesses may develop. Teeth look longer as gums begin to recede and front teeth may begin to drift, showing spaces with bad breath and bad taste too. Both horizontal and angular bone loss on X-ray is visible. Pockets between teeth and gum range from 4-6mm deep.
In Advanced Periodontitis, teeth may become mobile or loose. Bad breath and bad taste are constant. Roots may be exposed and are sensitive to hot and cold. Severe horizontal and angular bone loss on X-ray and pockets between teeth and pockets now become deeper than 6mm.

2.2 EPIDEMIOLOGY OF PERIODONTAL DISEASE

Epidemiological studies indicate that the disease is mainly found in early childhood, but more common in adolescence. Prevalence of the disease in school children has been found to be 40-60% and 50% in adults with at least 3-4 teeth involved. However, some improvement in the prevalence has also been seen over last 25 years. Prevalence of severe forms of periodontitis was found to be 5-15% and that of mild to moderate forms of periodontitis in 80% of adult population. African-Americans and Native Americans have a greater prevalence of periodontitis. (Vipin Agarwal et al., 2010) In a study by Marshall-Day et al., (1950) showed that gingivitis with no bone loss was seen in very few cases. With increase in age, periodontal destruction also increases. 100% occurrence of periodontal destruction was seen after 40 years of age. In 1960s and 70s (Schurch et al., 1990) found periodontal disease appears to be a major, global public health problem affecting adults 35-40 years of age. It starts as gingivitis and if left untreated leads to progressive bone loss.

Age and oral hygiene are major risk factors for periodontal disease. Baelum et al., (1993a) gave more focus on extent and severity of disease rather than just presence or absence. Gingival disease does not always progress to bone loss and not
all people with poor oral hygiene develop destructive periodontal disease. Hence "Individual susceptibility" plays a major role in periodontal destruction.

Bacterial plaque is not the sole factor leading to disease. Etiologic attribution reveals that 20% of bacterial infection, 50% of genetic variance and rest 20% of tobacco use contributes to the disease. The disease holds multi-factorial etiology including microbial ecology, host susceptibility and mucosal immunity. Risk factors that can affect the onset of periodontitis, rate of progression, severity of periodontitis, and the response to therapy can be categorized into Non-modifiable risk factors and Modifiable risk factors (Albandar, 2002).

2.2.1 Non-modifiable risk factors include age, gender, race/ethnicity and gene polymorphisms:

Gingivitis, in varying degrees, is nearly a universal finding in children and adolescents. In rare genetic cases, children and adolescents are subject to destructive forms of the disease. Researchers have also observed some of the organisms seen in periodontal disease in young children without signs of gum problems. Healthy children, however, do not generally harbor two primary periodontal bacteria, P. gingivalis and T. denticola. The disease is also uncommon in teenagers (Albandar et al., 2002; Agbelusi et al., 2006).

Increase in severity and prevalence of the disease increase with age. As the age increases, attachment loss increases. Over half of American adults have gingivitis surrounding 3 - 4 teeth, and 30% have significant periodontal disease surrounding 3 - 4 teeth.
In a study of people over 70 years old, 86% had at least moderate periodontitis, and over a quarter of them had lost their teeth. Effect of the disease gets reduced after adjusting for covariates such as systemic disease, bad oral hygiene, medications, co-morbidities etc. (Albandar et al., 2000 and 1999; Sigurd et al., 1968; Locker et al., 2001).

About three-quarters of periodontal office visits are made by women, even though women tend to take better care of their teeth than men. Female hormones affect the gums, and women are particularly susceptible to periodontal problems. Hormone-influenced gingivitis appears in some adolescents, in some pregnant women, and is occasionally a side effect of birth control medication.

Gingivitis may flare up in some women a few days before they menstruate, when progesterone levels are high. Gum inflammation may also occur during ovulation. Progesterone dilates blood vessels causing inflammation, and blocks the repair of collagen, the structural protein that supports the gums.

Hormonal changes during pregnancy can aggravate existing gingivitis, which typically worsens around the second month and reaches a peak in the eighth month. Pregnancy does not cause gum disease, and simple preventive oral hygiene can help maintain healthy gums. Any pregnancy-related gingivitis usually resolves within a few months of delivery. Because periodontal disease can increase the risk for low-weight infants and cause other complications, it is important for pregnant women to see a dentist.
Oestrogen deficiency after menopause reduces bone mineral density, which can lead to bone loss. Bone loss is associated with both periodontal disease and osteoporosis. Bone loss in the alveolar bone (which holds the tooth in place) may be a major predictor of tooth loss in postmenopausal women. Periodontal disease is the main cause of alveolar bone loss. During menopause, some women may also develop a rare condition called menopausal gingivostomatitis, in which the gums are dry, shiny, and bleed easily. Women may also experience abnormal tastes and sensations (such as salty, spicy, acidic, and burning) in the mouth. (Malisa et al., 1993).

Periodontal disease often occurs in members of the same family. Genetics, intimacy, hygiene, or a mixture of factors may be responsible for the same. Studies have found that children of parents with periodontitis are 12 times more likely to have the bacteria thought to be responsible for causing plaque and, eventually, periodontal disease.

Genetic factors may play the critical role in half the cases of periodontal disease. Up to 30% of the population may have some genetic susceptibility to periodontal disease. Kornmann in 1997 showed that IL-1 gene polymorphisms are related to the periodontal disease. Others include TNF-α, TGF-β1, Fc receptor of IgG, vitamin D receptor and others. About 50% of the periodontal disease can be attributed to genetic variance.

Intimate partners and spouses of people with periodontal disease may also be at risk. Researchers have found that the bacteria *P. gingivalis* may be contagious after exposure to an infected person over a long period of time. There is no risk from short
exposure, such as after a fast kiss or when sharing an eating utensil. (Chung et al., 1977).

Racial predominance of the disease goes with the African-Americans in the US showing the highest prevalence for periodontal disease, followed by Mexican-Americans and Non-Hispanic whites. Race is a social construct and also intertwined with low SES, income, education etc.

2.2.2 Modifiable/ Environmental/ Acquired/ Behavioral Risk Factors for the disease include Specific Microbiota, Cigarette smoking, Psychosocial factors and several systemic diseases:

In relation to the oral micro-organisms, the periodontal pathogens include, for example, *Aggregatibacter* (formerly: *Actinobacillus*) *actinomyctemcomitans*, *Prevotella gingivalis*, and *Bacteroides forthysus* (*Tannerella forythia*) (Socransky & Haffajee, 2003; Kononen et al., 2007; Ready et al., 2008). Although these periodontal pathogens form a part of the normal residential micro flora in the oral cavity, when the ecological balance among them is disturbed, this might favour the initiation, establishment and progression of gingival diseases and thereafter, although not always, at unknown time, conversion from gingival to periodontal disease (Kononen et al., 2007).

Cigarette Smoking leads to more plaque formation, more number of harmful bacteria, modified immune response, vascular changes and direct toxic effect.
Smoking is the single major preventable risk factor for periodontal disease. The habit can cause bone loss and gum recession even in the absence of periodontal disease.

A number of studies indicate that smoking and nicotine increase inflammation by reducing oxygen in gum tissue and triggering an over-production of immune factors called cytokines (specifically ones called interleukins). In excess, cytokines are harmful to cells and tissues.

Furthermore, when nicotine combines with oral bacteria, such as *P. gingivalis*, the effect produces even greater levels of cytokines and eventually leads to periodontal connective tissue breakdown. Smokers may be more than 10 times more likely than nonsmokers to harbor the bacteria that cause periodontal disease and are also more likely to have advanced periodontal disease.

The risk of periodontal disease increases with the number of cigarettes smoked per day. Smoking cigars and pipes carries the same risks as smoking cigarettes. Exposure to secondhand smoke may also be associated with an increased risk for developing periodontal disease, according to one study. Fortunately, when smokers quit, their periodontal health gradually recovers to a state comparable to that of nonsmokers. Some research also indicates that regular cannabis (marijuana) smoking also increases the risk of periodontal disease. (Amarasena et al., 2002).

2.2.3 Chewing Stick

Chewing stick or natural toothbrush is called with various names such as Miswak, siwak. (Hattab, 1997; Al Sadhan & Almas, 1999). Generally chewing sticks
are prepared from arak (Salvadora perisca) in geographical areas where it does not
grow it is prepared from other plants. Sticks of various trees especially Neem
(Azadirachta indica), Zaitoon (Olea europaea), kikar (Acacia arabica), Ban
(Glycosmic pentaphylla), Khiran (Capparis aphylla), Meyinro (Serindeia warneckei),
Orin Ata (Fagara zanthoxyloides), Ayan (Distemonanthus benthamianus), Pako Ijebu
(Massulaira acuminata), Pako dudu (Anogeissus leiocarpus), Ewuro (Vernonia
amygdalina), Igi emi (Bytyro sperma paradoxum), Pako pupa (Terminalia
glaucens), Egbo Egbesi (Nauclea latifolia), lime tree (Citrusauranta folia), orange
tree (Citrusinensis), bitter cola (Garcinia kola), Fagara zanthoxyloides, Chaw stick
(Gouania Lupuloides), senna (Cassia vinnea) African Laburnum(Cassia sieberianba)
have all been used as chewing sticks.

In Bangladesh the following plants are used as chewing sticks Nishinda (Vitex
negundo), Neem (Atzadirachta indica), Bely-asra (Achyranths aspera), Bhat
(Clerodendrum viscousum), Joytun (Sesbania sesban), Kaminee (Murraya paniculata),
Akondo (Calotropis procera), Khejur (Phoenix sylvestris), Bohera (Terminalia
belerica), Moth-bhringraj (Wedelia chinensis), Batul (Sapium indicum), Olut-kumbal
(Abroma angusta), Sheora (Streblus asper) and Motkila (Glycosmis arborea).(Almas
Rotami & Mosadomi, 1987, Almas & Lafi, 1995). At least 182 plant species are used
worldwide in preparing chewing sticks (Elvin-Lewis, 1982). Pencil-sized stick of
various plants of 10-25 cm long with diameter 1- 2 cm are prepared from the root,
stem, twigs or bark (Darout & Skaug 2004; Sadhan & Almas, 1999; Al-Lafi &
Ababneh, 1996).
Miswak has anti bacterial properties, anti cariogenic and anti periodontopathic properties (Al-Samh & Al-Bagieh, 1996; Darmani et al., 2006; Salehi & Danaie, 2006; Mehanna et al., 2009) and it releases into saliva substances that may explain its ability to reduce caries and periodontal disease (Akhtar & Ajmal1981; Wolinsky & Sote, 1984; Gazi et al., 1987; Rotimi & Mosadomi 1987; Gazi et al., 1991). In animal studies *Salvadora perisca* has also shown some anti-ulcer as well as anti-inflammatory properties (Monforte et al., 2001).

2.3 RELATIONSHIP OF MISWAK/SIWAK (*SALVADORA PERISCA*) TO ORAL HYGIENE

2.3.1 Plaque reduction

A cross sectional study done in Ghana (Norton & Addy, 1989) indicated that there was more plaque and gingival bleeding among chewing stick users than I tooth brush users. In contrast no such difference was found among children aged 7-15 years in Tanzania (Normark & Mosha, 1989). Controlled longitudinal trails conducted among children in Ethiopia (Olsson, 1978) and adolescents in Nigeria (Sote, 1987) have shown the chewing stick (*Massularia acuminata*) to be as effective as the tooth brush. Gazi et al., (1990) found that plaque and gingivitis were significantly reduced when Miswak was used 5 times a day compared with conventional toothbrush. In a study among Sudanese adult population it was found that those who used miswak (*Salvadora perisca*) had better oral hygiene, lower levels of oral pathogens and even had lesser calculus in posterior sextants than the toothbrush users (Darout & Skaug, 2004). Thus chewing sticks are as effective as toothbrush for reducing plaque (Batwa et al., 2006). The mechanical effect of the frayed fibres and the chemicals released
during the course of chewing may play the role in promotion of good oral hygiene (Wu et al., 2001).

2.3.2 Dental caries

In an in vivo study to compare the immediate antimicrobial effect of Toothbrush and Miswak (*Salvadora perisca*) it was reported that the reduction of *streptococcus mutans* was significantly greater in subjects using miswak (*Salvadora perisca*) than those using tooth brushing (Almas & Al-Zaid, 2004).

2.3.3 Gingival recession

Higher prevalence of gingival recession among adults in Tanzania is supposed to be caused by use of chewing stick (Van Palenstein Helderman et al., 1992). Younes and Elnegebawi, (1983) reported that about 22% of the Saudi children with gingival recession used Miswak the studied group also had low percentage of calculus deposits. The gingival recession seen in these Miswak users may be due to poor techniques.

2.3.4 Occlusal wear

Use of chewing sticks has been reported to be significantly correlated with occlusal tooth wear in young Saudi population (Johansson, 1991).

2.3.5 Tooth loss

In a study conducted among 206 participants from Tanzanian rural population it was reported that tooth loss was significantly higher in chewing stick users than among plastic toothbrush users (Mumghamba & Fabian, 2005).
Today, chewing sticks are still used in many developing countries because of religion and or tradition, and because of their availability, low cost and simplicity. The World Health Organization also encourages their use (WHO, 1987).

The Year 2000 Consensus Report on Oral Hygiene states that chewing sticks may have a role to play in the promotion of oral hygiene, and that evaluation of their effectiveness warrants further research (Wu et al., 2001).

2.4 SYSTEMIC DISEASES

Periodontal Disease when associated with Diabetes Mellitus leads to vascular changes including Impaired collagen metabolism, advanced glycation end products (AGE's), altered subgingival microbiota, increased gingival crevicular fluid (GCF) glucose, impaired host defence: dysfunctional WBCs, and altered polymorphonuclear (PMN) migration. Other diseases that have shown associations with periodontal disease but still need studies demonstrating a casual relationship are cardiovascular diseases, Obesity, Osteopenia/Osteoporosis, HIV and Psychological factors.

It is hard to compare different studies because of lack of uniformity in study design in different population, different definition of periodontal disease, and different statistical methodologies. Most of them are easy to examine associations, but hard to establish causality cross-sectional data. Also due to multi-factorial etiology of periodontal disease it becomes very difficult to isolate the exposure of interest (Seymour et al., 2007).
A cross-sectional study was conducted among 299 dentate diabetics attending a diabetic clinic in Tehran, Iran. A self-administered questionnaire was administered during a dental appointment in order to gather information about year of birth, year of onset of diabetes, education and organ complications related to diabetes. Number of teeth, the Community Periodontal Index of Treatment Needs and visible plaque were recorded. None of the subjects had a healthy periodontium. Shallow periodontal pockets were the most prevalent finding. Periodontal pockets exceeding 5mm and a higher number of missing teeth were associated with a low level of education. The sum of plaque scores [odds ratio (OR) 1.3; 95% confidence interval (CI) 1.1-1.5] was related to the presence of deepened pockets when controlling for other factors. The poor periodontal status of our diabetic patients indicates a need to establish a comprehensive oral health promotion programme for diabetics based on collaboration between dental and general health care professionals involved in diabetic care (Bakhshandeh et al., 2007).

Diabetes increases salvia sugar and changes its bacterial flora these changes destroy periodontal tissues. In a study using CPITN index the intensity of periodontal damage was compared in insulin depended with healthy individual. CPITN index was measured in 132 insulin depended diabetic patients and 132 healthy individual. The results showed that there was no significant difference for CPITN index in male and female diabetic patients. CPITN index in diabetic patients was 1.36±1.24) and was significantly higher than healthy individuals (0.54±0.77). It was concluded that saliva changes in diabetic patients and changes in oral microorganism explains this difference (Shahabooei et al., 2005).
Chronic periodontitis has been associated with an increased risk for cardiovascular disease. Left ventricular mass is an established independent predictor of cardiovascular disease. In the present cross-sectional study, we tested the association between periodontitis and left ventricular mass in subjects with essential hypertension. One hundred and four untreated subjects with essential hypertension underwent clinical examinations, including echocardiograph study, laboratory tests, and assessment of periodontal status according to the community periodontal index of treatment needs (CPITN). With increasing severity of periodontitis, there was a progressive increase in left ventricle mass. Mean values (g/height\(2.7\)) were 39.0 (\(\pm\)2.7) in CPITN 0 (periodontal health), 40.2 (\(\pm\)6.4) in CPITN 1 (gingival bleeding), 42.7 (\(\pm\)6.8) in CPITN 2 (calculus), 51.4 (\(\pm\)11.7) in CPITN 3 (pockets 4 to 5 mm), and 76.7 (\(\pm\)11.3) in CPITN 4 (pockets \(\geq\)6 mm) (overall \(F = 51.2; P < 0.0001\)). Body surface area (\(P = 0.04\)), systolic (\(P = 0.0001\)) and diastolic (\(P = 0.01\)) blood pressure, and left ventricular mass (\(P = 0.0001\)) were determinants of a composite of CPITN 3 and 4. In a multivariate logistic analysis, left ventricular mass was the sole determinant (\(P = 0.0001\)) of CPITN stages 3 and 4. These findings suggested a direct association between severity of periodontitis and left ventricular mass in subjects with essential hypertension. Periodontal evaluation might contribute to refine cardiovascular risk assessment in hypertensive subjects. (Fabio Angeli et al., 2003).

2.4.1 Screening of periodontal disease with different indices

The method for the assessment of periodontal disease involves clinical examination of the periodontal tissues and/or radiological assessment of the alveolar bone loss. However, for the purpose of estimating the prevalence of periodontal
disease in a population, radiographs are rarely used because of ethical and practical considerations (Berk & Arbes, 2006).

2.4.2 Periodontal Index (PI)

The Periodontal Index (PI) was developed in the 1950s for the purpose of assessing periodontal disease (Russell, 1956) and was widely used until the 1980s (Papapanou & Lindhe, 2003). Using a light source, a mouth mirror and an explorer rather than a periodontal probe, the PI assessed the periodontal tissue and was scored as no overt gingival inflammation (0), mild gingivitis (1), gingivitis (2), gingivitis with pocket formation (6) and advanced destruction of the periodontal tissue with tooth mobility and loss of masticatory function (8) (Diamanti-Kipioti et al., 1993; Ainamo et al., 1993).

2.4.3. Periodontal Disease Index (PDI)

The development of the Periodontal Disease Index (PDI) was a result of challenges faced by the World Health Organization experts in the assessment of periodontal diseases in Asia (Ramfjord, 1959). The PDI assesses the severity of gingival and periodontal tissue destruction and scores the healthy gingival tissue (G0), mild to moderate gingivitis on part of tooth (G1), mild to moderate severe gingivitis all around the tooth (G2), severe gingivitis with ulceration (G3), gingival sulcus extending 0–3 mm (G4), and periodontal pockets 3-6 mm and ≥6 mm (5) and (6), respectively. The PDI uses the six pre-selected teeth (Ramfjord teeth) rather than the full mouth examination, and the teeth include the maxillary right first molar, maxillary left first central incisor, maxillary left first premolar, mandibular left first molar,
mandibular right first central incisor, and mandibular right first premolar sum of tooth scores.

The PDI for the individual is the sum of the tooth scores divided by the number of teeth examined. Although the PDI is rarely used today, Ramfjord’s teeth continue to be used in many epidemiological studies (Berk & Arbes, 2006).

2.4.4 The Extent and Severity Index (ESI)

The Extent and Severity Index (ESI) was developed to assess separately the extensiveness and the severity of periodontal disease destruction in an individual and a population (Carlos et al., 1986). The ESI does not involve the assessment of gingival inflammation but deals with loss of attachment using an indirect approach that was used by Ramfjord whereby the loss of attachment was calculated as the distance from the gingival margin to the bottom of the pocket minus the distance from the gingival margin to the cemento-enamel junction (Berk & Arbes, 2006). The extent of periodontal disease in an individual refers to the percentage of sites examined that have an attachment loss greater than 1 mm, while the severity score denotes the average loss of attachment per site among the affected sites (Carlos et al., 1986). The ESI is expressed as a bivariate statistic. For example, ESI (10, 5.0) would be interpreted as 10% of the sites examined had periodontal disease, and at the affected sites, the average loss of attachment was 5.0 mm, thus showing a minority being affected with severe periodontal destruction. The ESI for a population would be the average extent and severity scores for the individuals examined.
2.4.5 Community Periodontal Index of Treatment Needs (CPITN)

This index was developed for the “Joint Working Committee” of the World Health Organization” and “Federation Dentaire Internationale” (WHO/ FDI) by Jukka Ainamo, David Barmes, George Beagrie, Terry Cutress, Jean Martin and Jennifer Sardo-infirri in 1978. It was developed primarily to survey and evaluate periodontal treatment needs rather than determining past and present periodontal status, i.e., the recession of the gingival margin and alveolar bone (Ainamo et al., 1982). Also, it provides guidance on the planning and monitoring of the effectiveness of periodontal care programmes and the dental personnel required.

The CPITN is a procedure which uses clinical parameters and criteria relevant to planning for the prevention and control of periodontal diseases. Treatment needs implies that CPITN assesses only those conditions potentially responsive to treatment, but not non-treatable or irreversible conditions (i.e. recession, attachment level).

The dentition is divided into six parts (sextants) for assessment of periodontal treatment needs. The upper right first and second molars in sextant one, upper right central incisor in sextant two, upper left first and second molars in sextant three, lower left first and second molars in sextant four, lower left central incisor in sextant five, and lower right first and second molars in sextant six. In accordance with the International Dental Federation (FDI), the CPI Index teeth are tooth numbers 17, 16, 11, 26, 27, 37, 36, 31, 46 and 47 (WHO, 1997).

Each sextant is given a score. For epidemiological purposes, the score is identified by examination of specific index teeth. For clinical practice, the highest
score in each sextant is identified after examining all teeth. The recommended periodontal probe for use with CPITN was first described by WHO. This probe was designed for two purposes, namely measurement of pocket depth and detection of subgingival calculus.

The CPITN probe is both thin in the handle and is of very light weight (5 gms). This probe is particularly designed for gentle manipulation of the often very sensitive soft tissues around the teeth. A tooth is probed to determine pocket depth and to detect subgingival calculus and bleeding response. The probing force can be divided into a ‘working component’ - to determine pocket depth and a ‘sensing component’ - to detect subgingival calculus. The working force should not be more than 20 grams.

The probe is inserted between the tooth and the gingiva, and the sulcus depth or pocket depth is noted against the colour code or measuring lines. The ball end of the probe should be kept in contact with the root surface. The direction of the probe during insertion should, whenever possible be in the same plane as the long axis of the tooth. (Baelum et al., 1993a, 1993b, 1995; Bassani et al., 2006).

The CPITN scored the specific “conditions”, as well as the “disease situation” in a hierarchical manner including healthy periodontal tissue - score (0), gingival bleeding on probing (1), calculus (2), periodontal pocket 3.5-5.5 mm (3), and periodontal pocket >5.5 mm (4) (WHO, 1987). The treatment needs were categorized as oral hygiene instruction (OHI) - Code-I for sites that have gingival bleeding, removal of calculus (scaling) - Code-II plus OHI for sites that had calculus, and complex periodontal treatment that includes periodontal surgery - Code-III plus OHI
and calculus removal for sites that had shown presence of probing periodontal pockets >5.5mm (WHO, 1987).

From the use of the CPITN worldwide in more than 100 countries, there was a feeling that the system had gained wide acceptance due to its simplicity (Pilot & Miyazaki, 1994). However, the CPITN was later on modified to the Community Periodontal Index (CPI) alone when the treatment needs (TN) component was excluded from the index, and for practical reasons, the categorization of periodontal probing pocket depth was changed to periodontal pocket 4-5 mm (score 3), and periodontal pocket ≥6 mm (score 4) (WHO, 1997).

2.5 PERIODONTAL DISEASE IN DIFFERENT WHO REGIONS

The occurrence of periodontal diseases in man is a global problem (Albandar & Rams, 2002), thus affecting all continents, for example, Europe (Sheiham & Netuveli, 2002), Asia and Oceania (Corbet et al., 2002) North America (Albandar, 2002a), South America, for example, Brazil (Susin et al., 2005) and Africa (Baelum & Scheutz, 2002). Although periodontal diseases occur commonly among adults (Locker et al., 2001, Bourgeois et al., 2007), they are also prevalent in children and adolescents (Clerehugh & Tugnait, 2001, Albandar & Tinoco, 2002). Previously, it has been reported that periodontal diseases were among the most widespread diseases in mankind (WHO, 1978). On the basis of earlier epidemiological studies, it was considered that once a person suffered from inflammation in the form of gingivitis, this would progress to periodontitis with alveolar bone loss and finally cause tooth loss.
For all the WHO regions, periodontal index of 2 & 3 are most prevalent. 57% of the AFRO population in 35-44 yr age group has shown periodontal index of 2 followed by 30% population having periodontal index of 3. In case of AMRO, maximum of 45% population in the age group of 35-44 yr showed periodontal index of 3. 26% and 20% of the population were in the index of 2 & 4 respectively for AMRO region. EMRO region has a 40% population within periodontal index of 2, while 30% is with index 3. 44% population of EURO region has periodontal score of 2 and 28% population is with score 3.

SEARO regions has a very much concentrated population scatter in periodontal index 2 & 3 with 44% & 42% of population representation respectively WPRO region has 36% population with index 2 and 46% population with index 3 (Albandar et al., 2002).

From the data it can be concluded easily that AMRO region has the maximum number of population in the age group of 35-44 yr which has periodontal index in the range of 3~4. WHO regions were also compared individually, in 2004 and 2011 studies by A. Nithila et al., (2011) amongst age groups of 12 years, where AFRO, EMRO and SEARO regions showed rise of the disease, while others including AMRO, EURO and WPRO showed better health of the individuals. Against all the regions, EURO regions has showed maximum improvement in the disease levels. On the other hand, SEARO region has shown maximum deterioration amongst all WHO regions. (Craig et al., 2001)
2.6 PERIODONTAL STATUS IN AFRICA (Libya, Nigeria, Algeria, Chad, Egypt, Sudan, Tunis, Mauritania and Morocco)

Many studies have been conducted in Nigeria. Most of these studies have applied the CPITN, for example, studies by Harley and Floyd (1988), Adegbembo and El-Nadeef (1995), Kubota et al., (1988), and many others. The results show that the major problem is gingivitis and to a lesser extent periodontal disease. However, there are some studies that have shown a much higher proportion (5-80%) of participants in need of complex periodontal treatment (Adegbembo et al., 2000).

Studies done in North African countries like Libya, Algeria, Egypt, Chad, Tunis and Morocco by Haikel et al., (1989); Omar & Pitts, (1991) had shown a high proportion of study participants with gingivitis (98.7%). However, the periodontal pocket depth of ≤3.5 mm (4.1%) in Libya for the age group of 15-16 years (Omar & Pitts, 1991) might signal a problem of early stages of aggressive periodontitis unless the reported situation was associated with eruptional pseudo pockets. Study done by Attin et al., 1999 shows that for countries like Cameroon and Chad, gingival bleeding comprises of 37.7% of all clinical diagnosis. As per the study done by Elifuraha Godson Salum Mumghamba, Morocco had a high proportion of gingivitis (98.7%) in the sample population which was similar to the whole of West Africa.

Abdellatif Abid, (2004) did a comparative study among Tunisians, Moroccans and Mauritanians population and concluded that Tunisians reported greater percentage of healthy periodontium followed by Mauritanians and then Moroccans. With reference to Periodontal Index (PI) and WHO, 1971 and study done by Olsson 1978a
for North African countries like Ethiopia/ Egypt, indicates that periodontal pockets are present in 12% of population in 30-34 yrs, and 52% in 45-54 yrs. A study done by Abdellatif Abid, (2004), for Tunisian population between 15~19 years reported that around 16% of people showed gingival bleeding and 44% were having calculus.

The prevalence of periodontal diseases using other indices reported much higher percentages of periodontal destruction. At and after the age of 30 years, about 52% of the study participants were classified as having periodontitis (Olsson, 1978a), while in Egypt, only 8% had advanced periodontitis (Dowty, 1982). However, in populations where there were a higher (51%) proportion of people with attachment loss, the prevalence for gingival pockets remained low, at about 10% (Darout et al., 2000). In a similar study done in Sudan (Abdellatif Abid, 2004), it was observed that 23% of the sample population showed gingival bleeding whereas 33% were segregated in calculus stage of periodontal status.

As per the study done by Khalifa et al., (2012), for Sudanese population, in the 35-44 age group 36.1% had healthy periodontal tissues, 10.9% bleeding, 42% calculus, 8.5% 4~5 mm periodontal pocketing, 0.7% periodontal pocketing of > 6 mm, and 1.8% excluded sextants. Further, there was a clear trend of increasing calculus with respect to increasing age.

Petersen & Kaka 1999 have done a study on Nigerian and Tunis population of 12 years where 99.8% of them were found to be affected with gingivitis. Among 18 years periodontitis occurrence was found to be 0.6% which increases to 12.6% among 35-44 years of individuals.
The occurrence of periodontal diseases in countries that lie in the southern part of Africa showed that the populations had a problem of gingival inflammation, for example gingival bleeding prevalence was 80% (Brindle et al., 2000). However, most of the study populations were children between 5 and 12 years of age. Among the adult population, the periodontal treatment needs for complex periodontal care was between 4 and 5% (Arendorf et al., 2001).

The occurrence of periodontal diseases in East African countries in the age group of below or equal to 25 years most of the problems reported were ANUG (41%) by Wandera and Twa-Twa (2003), and early onset periodontitis (28.8%) by Albandar et al., (2002). Here, both the child and adult population had been studied, and among the school children studied, gingivitis prevalence was 25%. The prevalence of ANUG in children was very low, between 0.15 and 0.28%. For the adult population studied, aged 15-65 years, only 20% of the surfaces had loss of attachment ≥4 mm (Baelum et al., 1988).

The occurrence of periodontal diseases in urban and rural, as well as in child and adult populations in Tanzania has been studied. In child populations, gingivitis was the main problem and it varied between different studies (Frencken et al., 1986, Kerosuo et al., 1986, Kikwilu & Mandari, 2001). Frencken et al., (1986) reported that a rural child population (61%) was affected more than the urban child population (55%). However, a much lower proportion of children with gingival bleeding (25%) has been reported from the same region, but including a wider age span. In adult population, gingival bleeding was also prevalent, for example up to 94% (Baelum
1987, Lembariti et al., 1988). Previously, in 1967, it had been reported from the Usambara Mountains, particularly from Bumbuli and Mayo villages that more than 75% of the people over 20 years had different degrees of periodontal infection (Jacobson & Kreysler, 1967). Periodontal disease, among adults aged 30 years or more was 16% for the Morogoro population. In Zanzibar, loss of attachment and gingival recession were very common among the studied adult population (Baelum, 1987).

Using loss of attachment to assess periodontal status, it was reported that there was visually no loss of periodontal attachment before 30 years of age, and that at the age of ≥50 years, loss of attachment affected 60% of the subjects, and mostly at buccal rather than at lingual sites (Muya et al., 1984). When all these data are looked at altogether, it can be seen that there are some minor differences in periodontal conditions between one study and another as well as from one country to another. However, it appears that in most of the studied populations the severe form of periodontal disease affected only the minority. This finding is echoed by those from many other studies, and even the assumed differences between industrialized and non-industrialized countries.
### TABLE SHOWING COMPILATION OF THE DATA FROM VARIOUS STUDIES WHICH HAVE BEEN CONDUCTED TO ASSESS THE PERIODONTAL STATUS

<table>
<thead>
<tr>
<th>Country</th>
<th>Author &amp; year</th>
<th>Study sample (n)</th>
<th>Age in years</th>
<th>Index</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libya</td>
<td>Omar &amp; Pitts, 1991</td>
<td>2,015</td>
<td>7–16</td>
<td>CPITN</td>
<td>Age 15–16 years: 4.1% pockets (≥3.5 mm)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Harley &amp; Floyd, 1988</td>
<td>1,001</td>
<td>12–19</td>
<td>CPITN screening, clinical &amp; radiological</td>
<td>Periodontal disease 0.8%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Kubota et al., 1988</td>
<td>673</td>
<td>3–20</td>
<td>CPITN</td>
<td>Gingivitis 84.2%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Taiwo et al., 2004</td>
<td>690</td>
<td>≥65</td>
<td>CPITN</td>
<td>Periodontal pockets: 4–5 mm 21.6%, ≥6 mm 28.8%</td>
</tr>
<tr>
<td>Algeria</td>
<td>Haikel et al., 1989</td>
<td>2,378</td>
<td>7–60</td>
<td>CPITN</td>
<td>Gingivitis 98.7%, but low periodontal pockets</td>
</tr>
<tr>
<td>Chad</td>
<td>Petersen &amp; Kaka, 1999</td>
<td>1,473</td>
<td>6, 12, 18, 35–44</td>
<td>CPITN</td>
<td>12 years: gingivitis 99.8% 18 yrs: periodontitis 0.6% 35–44 years: periodontitis 12.6%</td>
</tr>
<tr>
<td>Egypt</td>
<td>Dowty, 1982</td>
<td>426</td>
<td>4–7</td>
<td>Not CPITN</td>
<td>High prevalence of intense gingivitis Advanced periodontitis 8%</td>
</tr>
<tr>
<td>Sudan</td>
<td>Darout et al., 2000</td>
<td>213</td>
<td>20–65</td>
<td>CPITN</td>
<td>Pockets ≥4 mm 10% Loss of attachment ≥4 mm 51%</td>
</tr>
<tr>
<td>Sudan</td>
<td>WHO, 1993</td>
<td></td>
<td></td>
<td></td>
<td>23% gingival bleeding whereas 33% calculus</td>
</tr>
<tr>
<td>Sudan</td>
<td>Khalifa et al., 2012</td>
<td>1888</td>
<td>35 - 44</td>
<td>CPITN</td>
<td>10.9% bleeding, 42% calculus, 8.5% 4–5 mm periodontal pocketing, 0.7% periodontal pocketing of &gt; 6 mm, and 1.8% excluded sextants</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Abdellatif Abid, 1995</td>
<td>600 – 700</td>
<td>12 – 15</td>
<td>CPITN</td>
<td>70% severe Periodontitis</td>
</tr>
<tr>
<td>Libya</td>
<td>Fanas et al., 2008</td>
<td>2015</td>
<td>7-16</td>
<td>CPITN</td>
<td>Age 15-16 years: From Rural areas had signs of periodontal pocketing.</td>
</tr>
<tr>
<td>Morocco</td>
<td>Haikel et al., 1989</td>
<td>2378</td>
<td>7-60 years</td>
<td>CPITN</td>
<td>High prevalence of gingivitis and low prevalence of deep pocketing.</td>
</tr>
</tbody>
</table>
2.8 GENERAL INFORMATION ABOUT LIBYA

Libya is one of the North African countries, in the Mediterranean region and is bordered by Egypt and Sudan in the east, Chad and Niger in the south, Algeria and Tunis in the West while on the northern side lays the Mediterranean Sea. It has one of the lowest population density rates in the world, at 2.9 persons per km². The living standards of Libyans have improved significantly since the 1970s, ranking the country among the highest in Africa. Urbanization, developmental projects, and high oil revenues have enabled the Libyan government to elevate its people's living standards. The social and economic status of women and children has particularly improved. Various subsidized or free services (health, education, housing, and basic foodstuffs) have ensured basic necessities. Libya is not a highly polarized society divided between extremes of wealth and poverty.

2.9 PERIODONTAL STATUS IN SEBHA CITY, LIBYA

Sebha is the largest city in the south of the Libyan Arab Jamahiriya and is in the middle of Libyan Desert. People come to Sebha from the various urban and rural areas surrounding it and therefore it has a heterogeneous society (Hassan, 2000). Literature search for the oral health status of Sebha resulted in presence of only one pubmed indexed article by Hassan AK\textsuperscript{8} and one document which was an assignment report of oral health situation in Socialist People’s Libyan Arab Jamahiriya submitted to WHO Geneva Leous, (1993) in 1982-83.

The study by Hassan, (2000) among patients attending dental clinic in Sebha, Libyan Arab Jamahiriya, reported that the people have poor oral hygiene and low
level of education. There is a high rate of tooth extraction resulting from 54% dental caries and 41% periodontal disease.

The report by Leous (1993), on the oral health situation in Socialist People’s Libyan Arab Jamahiriya was a pathfinder study conducted on 849 children and 220 adults from 14 sites of the following localities namely Tripoli, Sebha, Benghazi, Zwara, Ajelat and Kaddah. For obtaining the oral data: Dental caries, fluorosis, periodontal disease, dentofacial anamolies, oral mucosal disease and treatment needs were assessed. CPITN index was used to assess the periodontal disease and its results indicate that the periodontal disease was present from a very young age. At age 15, 100% had bleeding and calculus. Very few persons at age 20-24years had healthy periodontium. The oral hygiene of the children was neglected which was the main reason for periodontal disease.

There was increased tooth loss by the age of 55-64 years. High prevalence of periodontal disease was the main cause of tooth loss in adulthood. From the Sebha locality, Sebha city and rural Sebha were considered. The sample size was only 20 which seem to be very small number. The results for Sebha city showed that, there was none with healthy gingiva. The average number of segment with bleeding was 4.8 and calculus was 3.8. There were presence of shallow pockets but no deep pockets were recorded.

To achieve the goal of oral health by the year 2000, the priority area identified was primary prevention of periodontal disease and loss of teeth due to caries. It was
also aimed to reduce the periodontal disease to 50% by the year 2000 for 15 years old as in 1982, 100% rural and 95% of the urban population had periodontal disease.

Three decades have past after the submission of the assignment report to WHO. During this period there is no mention in the literature about any further development in terms of achievement of oral health goal set for 2000, any programs developed and implemented or any survey conducted on a nationwide level to evaluate the oral health condition.
AIMS AND HYPOTHESIS OF THE STUDY

General Aim

The general aim of the present study was to assess oral hygiene practices, establish a preliminary picture of the periodontal status and to investigate its relationship with its determinants like age, sex, smoking and systemic diseases such as diabetes and hypertension among general population in Sebha city, Libya.

Specific Aims

Specific aims of the present study were as follows:

- To assess oral health practices among the general population.
- To determine their periodontal status.
- To determine the occurrence of periodontal status in relation to oral hygiene practices.
- To assess smoking and its relation to their periodontal status.
- To assess the relationship of age and periodontal status.

Working Hypotheses

Working hypotheses were as follows: a) Use of traditional oral hygiene practices will be common among the population of Sebha city, Libya b) Greater risk of periodontal diseases c) Greater exposure to smoking is related to poorer periodontal status. d) Systemic diseases are related to poorer periodontal status.