

Tobacco and Oral Health

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Introduction

Tobacco remains one of the most important preventable causes of addiction, sickness and mortality in the world. The development of potentially malignant oral lesions as well as various other undesirable conditions are the direct result of tobacco use, yet on the whole knowledge of these implications amongst the general public is very limited. This is a worrying situation that requires urgent attention given that the mortality rates associated with oral cancers are high and that the main causes of them are directly attributed to lifestyle habits such as smoking, betel quid chewing and excessive alcohol consumption. With early diagnosis, cancer treatment is straightforward, survival rates high and many of the associated side-effects, such as severe gingivitis, are non-permanent and improve over time.

The effects of tobacco

The smoking and chewing of tobacco products has a number of well documented side-effects on the oral cavity. These cover a range of implications from those that alter a person's appearance to others that are potentially fatal. The following are the main areas that tobacco is known to affect:

Aesthetics

The smoking and chewing of tobacco products can have a dramatically detrimental effect on the appearance of people, ranging from yellowed fingers to smoker's face. Specifically tobacco use affects the aesthetics of the face and mouth in the following ways:

- Tobacco stains and discolours teeth, dentures and restorations. [1], [2]
- Pipe smokers and smokeless tobacco users are prone to excessive wear on their teeth, which often become flat. The eventual exposing of tooth dentin can lead to deep tobacco staining.[3]
- Tobacco, whether smoked or chewed, can cause halitosis.³
- Cleft lips and palates are twice as common amongst children born to mothers who smoked during pregnancy.[4]
- Heavy smoking can cause an overgrowth of the papilla of the tongue surface. This brown, furry growth traps germs and eventually creates a burning sensation on the tongue and exacerbates bad breath. ³
- Tobacco-associated bad breath is related to the strength of tobacco smoked. Pipes and cigar tobacco contain a higher concentration of sulphur that produces stronger bad breath. The use of breath freshening mints to alleviate the bad breath can themselves cause dental erosion due to the large quantities of sugar and citric acid contained in them.[5]
- Smokers have higher levels of calculus formation than non-smokers. Calculus deposits make it easier for plaque to stick to teeth and cause gum disease and cavities to form.⁴

Dental caries

Although smoking is a commonly included factor in the analysis of rates of caries there is still insufficient evidence for any aetiological relationship.¹

Dental implants

Tobacco can be damaging to both the initial and long-term success of dental implants.¹ Indeed, in one study smoking was the most significant factor predisposing implant failure - rates were 4.8% in non-smokers and 11.3% in smokers.[6]

Healing of wounds

Tobacco is a peripheral vasoconstrictor which influences the rate at which wounds heal within the mouth.[7] Carbon monoxide and other chemicals produced during the combustion of tobacco can reduce the capillary blood flow within the mouth - research has suggested that a single cigarette can reduce the peripheral blood velocity by 40% for one hour.⁷ Consequently healing is much slower and not as successful following oral surgery on smokers.⁴ The resulting absence of blood clotting that follows the removal of teeth (referred to as dry sockets or localised osteitis) occurs 4-times more frequently in smokers than in non-smokers.[8] Studies have also shown that smokers have a 50-100% inhibition of the function of polymorphonuclear leukocytes (white blood cells which help fight infection) compared to non-smokers.[9]

Heart disease

There is increasing debate as to whether poor oral health (in particular periodontitis) can be a cause of pulmonary heart disease. Studies from the 1980s and 90s have shown[10] that there is an association

between the two: though the precise mechanisms of how this occurs are not fully understood. It is believed that certain oral bacteria, such as *Streptococcus sanguis*, play a major role: when the bacteria enter the bloodstream through diseased gum tissue they cause blood platelets to clump together and start clotting, which can eventually lead to a heart attack.^[11] In addition, inflammatory white blood cells and fibrinogen are found in higher concentrations in sufferers of periodontitis and these have been known to increase the risk of heart attack.

However, a more recent study by the University of Washington State^[12] concluded that people with and without dental infections had the same risk of heart disease. The University of Washington report claims that the link between oral health and heart disease only existed in the first place because earlier studies had not adjusted their data to take into consideration the effects of smoking. These studies showed “an association between gum disease and stroke, coronary heart disease, low birth weight, chronic obstructive pulmonary disease and lung cancer. All of these diseases are smoking-related”.^[13] Despite the contradictions in the research, it is clear that the best way to ensure good oral health and to reduce the risk of heart disease is to stop smoking.

Oral cancer

It is well documented that tobacco has a direct carcinogenic effect on the epithelial cells of the oral mucous membranes.¹ The British Dental Association (BDA) defines oral cancer based on a series of risk factors and includes all cancers of the lip (code 140), tongue (141), gingiva (143), mouth floor (144), oropharynx (146) and hypopharynx (148), but not cancers of the major salivary glands and nasopharynx.^[14]

The commonest form of oral cancer - squamous cell carcinoma which accounts for 95% of all oral cancers -^[15] can be clearly attributed to certain lifestyles (up to 70% of all confirmed cases^[16]) and, despite occasionally occurring in people who might not normally be considered “at risk” (the remaining 30%¹⁶), it can be considered a preventable disease.¹⁴ Studies suggest that the incidence of oral cancer among smokers is between 2 to 18 times more frequent (with a median value of 4 times) than with non-smokers.^[17] Smokeless tobacco users are also at an increased risk.¹⁴ Stopping smoking eliminates the increased risk of oral cancer after 5-10 years.¹⁴ Most cancers occur within the oral cavity itself: the most common place for them to exist are the tongue (20%), with other areas including the gingiva (gums) (18%), floor of mouth (12%), lip (11%) and salivary gland (8%).⁴

In addition to cancer, potentially malignant lesions of the mucous membranes, pre-cancers or leukoplakia, occur 6-times more frequently in smokers than non-smokers.¹⁴ Studies have shown that between 3 to 28% of all leukoplakia will become malignant. ^{[18], [19], [20], [21], [22]} Although not limited exclusively to smokers, the formation of leukoplakia has been linked to smoking and the use of smokeless tobacco.³ Between 40-60% of smokeless tobacco users have a lesion in the mouth where tobacco is stored which occurs within a few months of use. ^{[23], [24], [25]} Cessation or reduction of tobacco intake may help the regression or disappearance of leukoplakia.^[26]



The major risk factors associated with oral cancer are as follows:

- Smoking tobacco – cigarettes, pipes and cigars
- Smokeless tobacco (chewing tobacco) – e.g. snuff, gutkha, betel quid
- Excessive alcohol consumption
- Prior history of oral cavity / aerodigestive cancers
- Age
- Deficiencies in diet, especially of certain vitamins including A, C and E

In addition to the above, there are numerous minor risk factors that should be considered when considering oral cancer susceptibility. These include: ⁴

- Genetic / familial disposition
- Environmental pollution, especially burning of fossil fuels
- Excessive exposure to sunlight

- Candida albicans yeast fungi infection

The increased risk to smokers who drink heavily is worthy of further examination. Alcohol increases the permeability of the oral mucous membranes which is thought to enhance the carcinogenic effect of tobacco based products.^[27] Estimates suggest that alcohol drinking and smoking account for 75% of all oral and pharyngeal cancers diagnosed within the USA. 20 Various studies have shown that a causative relationship exists between oral cancer and the heavy intake of alcohol, the evidence from which indicates that the combination of tobacco and alcohol use raises the risk for oral cancer significantly more than the use of either substance alone. Smokers who drink heavily have a 6-15 times greater risk of developing oral cancer than non-smokers/drinkers.^{[28], [29]} Smokers who do not use alcohol still have a 2 to 4-fold increase in the risk. It is also interesting to note that there is a strong correlation between the incidence of oral cancer and poverty in the UK.^[30] Statistics show that the highest number of oral cancer cases occur within the most deprived areas of Britain. In Scotland, the risk of men from the poorest regions developing cancer in their mouths is over 4 times the rate for men in the most affluent ones.³⁰

Oral cancer statistics

For both genders combined, cancer of the mouth and pharynx is the sixth most common type of cancer overall in the world.^[31] In industrialised countries, men are affected two to three times as often as women, largely due to higher use of alcohol and tobacco.³¹ In England and Wales, oral cancer is the eleventh most common malignancy in men and the sixteenth most common in women. Each year in the UK, about 3800 new cases are diagnosed and there are around 1700 deaths.^[32] The incidence of oral cancer increases with age and in the UK the majority of cases (85%) occur in people aged 50 or over. Mortality from oral cancer has decreased since 1950 in both sexes. In the 1990s mortality was less than half that in the early 1950s. Scotland, Wales and Northern Ireland all have higher incidence levels than England. In England and Wales there were 2766 new cases in 1990 and 1307 deaths in 1995, which gives a ratio of deaths to cases of 0.47. By 1992 the ratio was still 0.46 (2988 new cases and 1386 deaths by 1997). Compared to other more publicised cancers, oral cancer generally has both less publicity ^[33] and a worse ratio of deaths to cases: 8

Cancer Type	1992 Cases	1997 Deaths	Cases / Death Ratio
Oral	2,988	1,386	0.46
Skin Melanoma	4,151	1,378	0.33
Breast	31,843	11,980	0.38
Cervix uteri	3,400	1,225	0.36
Prostate	15,705	8,523	0.54

The 5-year survival rate for early stage tumours is 80%, but falls to 15% for advanced ones.^[34] On a global scale, oral cancer incidence shows considerable international variation, with the Indian sub-continent, especially Bangladesh having the world's highest rate. This is important given the number of communities within the UK who originate from the sub-continent and the number of people within these who chew betel quid or paan.^[35]

Oral mucosal diseases

Tobacco is associated with a range of changes to the oral mucous membrane cells, including reversible impacts such as smoker's palate and more dangerous ones such as oral cancer.¹ The diseases most commonly associated with smoking are:

- Smoker's palate (nicotinic stomatitis): A change in the hard palate caused by heavy smoking. The palate turns white and can be littered with red dots located within small raised lumps. This condition is not pre-malignant and disappears after smoking is stopped, though some severe forms can progress to oral cancer.³
- Smoker's melanosis: White caucasian smokers are 3 times as likely to show a melanin pigmentation of their mucous membranes.^[36] Again, the condition is not pre-malignant and is reversible, though it can take up to 1 year after the cessation of smoking for benefits to accrue.¹
- Oral Candidosis: Several reports have shown that smoking is a factor in the appearance of oral candidosis, although the actual pathogenic role of tobacco in this is unknown.^[37]
- Chronic sinus infections: People who are especially sensitive to tobacco smoke can develop swelling in their nasal membranes and sinus cavities. Sinusitis occurs more regularly amongst smokers than non-smokers.³
- Smoker's lip: This is created by burns caused by smoking unfiltered cigarettes to the end, but is generally rare unless people are under the influence of alcohol.⁴

- Lichen Planus: A chronic inflammation that affects skin and the mucous membrane characterised by multiple white oral lesions that cannot be wiped away.⁴

Periodontal diseases



There is a clear association between smoking and both the existence and severity of periodontal diseases.^[38] Smokers tend to have greater gingival inflammation and harbour more supragingival plaque than non-smokers¹ and there is a higher pervasiveness of Acute Necrotising Ulcerative Gingivitis (ANUG or Trench Mouth), a painful infection of the gums that results in bleeding, heavy ulceration and very bad breath. People smoking 10 or more cigarettes a day have a far higher risk of developing it.³ The increased prevalence and severity of periodontitis in smokers results in greater marginal bone loss, deeper periodontal pockets, severe attachment loss and teeth furcation.^[39]

Certain studies have shown that tobacco users have 67% greater tooth loss than non-smokers.^[40] Periodontitis is diagnosed by the appearance of bleeding gums, but the chemicals contained within tobacco ensure that the gums themselves do not bleed as easily as normal. Smokers are 2 ½ to 3 times more likely to get acute periodontitis than non-smokers, regardless of age or sex.³⁹ This is a potentially dangerous disease because the patient could be unaware of any problems within their mouth and the disease could progress more rapidly.⁴ Other effects of tobacco in the oral cavity include leukodema and median rhomboid glossitis. Leukodema is an indistinct grey covering of the mucosa and occurs far more frequently in smokers than non-smokers. Though benign, the symptoms are aggravated by excessive smoking.⁴ Median rhomboid glossitis is characterised by a deep red or white lesion found on the tongue that destroys papillae⁴ and has been linked to smoking.^[41]

Salivary changes

It is thought that smoking increases the flow rate of the parotid gland⁵ but most evidence on the subject of saliva and smoking is inconclusive.⁴

Smell and taste

The smell and taste functions of smokers can be acutely affected by the gasses and chemicals within tobacco and the ancillary particulate matter associated with smoking.⁴ The greater the amount smoked, the greater the impact, and only once smoking is stopped do these functions begin to improve again.^[42] A reduced ability to taste and smell may lead to potentially problematic changes in diet such as an increased use of salt.⁴

Smokeless tobacco

Smokeless tobacco, which is chewed alone or with betel quid / paan, has a significant detrimental impact on the oral cavity. It has been recognised that the areca nut, an active ingredient in betel quid / paan, causes oral submucous fibrosis. This is a debilitating, non-reversible and pre-cancerous disease characterised by a stiffening of the oral mucosa and development of fibrous material that restricts mouth opening.^[43] The use of smokeless tobacco is known to induce wrinkled changes in the oral mucosa, so-called “snuff dipper’s pouches” that occur beneath the lip that can lead to severe gum recession and bone loss. Serious changes can occur in people who have used smokeless tobacco for only a short period of time, and though stopping can alleviate the wrinkling, damage to gums and bone is permanent.³



There have been a number of investigations into the implications of smokeless tobacco on South Asian populations in the UK, the majority of which show that betel chewing is prevalent [44] in many areas. This is of concern because other studies [45], [46], [47], [48] concluded that there is sufficient evidence to show that using smokeless tobacco heightened the risk of developing oral cancer. The studies found that:

- Betel / paan chewing with tobacco as an ingredient is carcinogenic.
- Chewing betel / paan may increase the risk of leukoplakia and periodontal diseases.
- There is a high frequency of oral cancer in areas where betel / paan chewing is prevalent.
- The perception of the risk of getting cancer from betel / tobacco is low in many areas, so much so that it was recommended that a Government Health Warning should be attached to any betel sold within the UK. 52 It was found that many people, especially the young, were only concerned about betel / paan chewing in terms of its appearance on their mouths.48
- Problems also arose because of the use of tobacco by a significant proportion of people as an aid to oral hygiene, many of whom had never visited a dentist.46

What can be done?

In contrast to its effect on other parts of the body, the health impacts of tobacco on the mouth receive relatively little attention and are not widely acknowledged, certainly amongst the general public. Obviously, dentists have a crucial role to play both in alleviating the impact of tobacco on oral health and disseminating information about it. Special attention must be given to highlighting the risks of oral cancer. Mortality rates for oral cancer are so high because many curable lesions are ignored and not diagnosed until they have become malignant. On average 4 people die every day from oral cancer in the UK. Clearly there is a need to raise public awareness of oral cancer and the numerous risk factors associated with it. Ignorance of the risk factors is more likely to result in the late diagnosis of cancers and can subsequently reduce the rates of successful recovery. The lack of understanding was highlighted in research centred on the north-east of England which revealed general ignorance of oral cancer, even among those people who had been in recent contact with the disease.35 Patients must be made particularly aware that certain lifestyles will make them more prone to oral cancer 14 while dentists should as a matter of routine opportunistically screen patients for oral cancer during check ups.

Dentists themselves should be encouraged to attend training courses to update their knowledge on the subject [49] and set up an effective screening strategy. The BDA recommends a three-step method aimed principally at changing the public's behaviour but also at improving the success of screening programmes: 14

Primary prevention

The first priority in the fight against oral cancer 14 is to change those habits known to increase the risk, especially the use of tobacco, heavy intake of alcohol and poor diet, which together account for up to 90% of all cases.[50] Stopping smoking may slow down or halt the development of periodontal diseases: research indicates that there is a lower incidence of oral diseases in former smokers compared to existing smokers.[51] One study found that 44 people who stopped smoking over a 10-year period had significantly less marginal bone loss compared to the 139 who continued to smoke during the same period.[52] Dentists have to shoulder most of the burden of changing smokers habits with regard to oral health - each year over 25 million people visit their dentist for an examination, giving dentists a great opportunity to screen for oral cancer. Risk-prone lifestyles can be assessed, advice on smoking cessation, diet and hygiene given, and early signs of cancer detected. Key messages to patients might include:

- Don't smoke.
- Don't drink alcohol to excess.
- Reduce the use of betel quid / paan and do not use tobacco in the quid.
- Eat more fresh fruit and vegetables.
- Ensure oral hygiene is improved.

Secondary prevention

The successful screening and detection of oral diseases, in particular cancers, is vitally important because of the inherent difficulty in changing individuals' lifestyles. Tobacco and alcohol addiction are hard to break, making detection of potential cancers at an early stage extremely important. It has been clearly illustrated that the earlier malignant or potentially malignant lesions are detected, the better the chance the patient has of making a full recovery. Screening programmes could be initiated proactively, along the lines of those for cervical cancer. However because so many people regularly see their dentist, it would probably be more effective to continue with an "opportunistic" approach every time the

patient visits their dentist. Because public awareness of oral cancer is low compared to other cancers [53] screening and detection obviously need to be improved, but there is no set figure for how often people should be routinely screened. The Government suggests that adults and children should see their dentist at least once a year, so it should be during these check ups that examinations should be done. Screening techniques available to dentists include visual and digital examinations as well as using tonium chloride staining rinses for high risk patients, which helps to identify malignant mucous membranes.

A methodical examination is the best way of detecting tobacco-related illnesses in and around the oral cavity. The World Health Organization recommends a simple 3 part procedure [54] that examines the extraoral regions of the head and neck, perioral and intraoral soft tissue, and lastly dental and periodontal tissue. This procedure should take no longer than 5 minutes.

- Extraoral examination – The dentist should inspect the neck, head and face to observe any noticeable changes such as growths and to note any new facial asymmetry.
- Perioral and intraoral examination – The examination should follow a step-by-step inspection of the lips, labial mucosa and sulcus; commissures, buccal mucosa and sulcus; gingival and alveolar ridge; tongue; floor of mouth; soft and hard palate.
- Dental and periodontal examination – Dentists should look out for colour changes on the root or coronal surface of the teeth, which are a direct result of tobacco smoking, as well as checking for gingival recession and attachment loss in areas where tobacco quids are stored.

Tertiary prevention

In order to stop the recurrence and spread of oral cancers,[55] dentists and other health specialists should work together to provide multi-disciplinary support for patients. Dentists may be able to influence politicians and communities to adopt relevant policies, but more importantly they can directly influence smokers to stop using tobacco, reduce alcohol consumption and improve their diet. Research has shown that the advice given by doctors and dentists is well respected by the vast majority of patients.50

Smoking cessation

The most important step that smokers need to take to improve their oral health and minimise the risk of oral cancer is to stop smoking. Dentists can play a vital role in this process, although the actual involvement of all health professionals is dependent on factors such as training and commitment rather than professional discipline.[56] Research has shown that smoking cessation works effectively and as such should be actively promoted by dentists – 3% more smokers who are given 10 minutes advice on how to stop by a health professional will abstain from smoking for six months or longer, than will smokers who receive no advice.[57] Whilst this may seem a small percentage, it means the actual number of people successfully quitting would be around 80,000.[58] Giving up smoking is a difficult process made up of a series of steps rather than one event and dentists can help smokers at the varying stages in the quitting process. Of utmost importance, however, is to let smokers know that it is never too late to stop smoking and that the sooner they do, the greater the benefits will be to their long term health.

There are 4 crucial steps in advising people to stop smoking, known as the “4 As” :

- ASK
- ADVISE
- ASSIST
- ARRANGE

Ask

It is very important that every patient has the status of their tobacco use noted and kept as up to date as possible, for example following every visit. At the very least this record should cover whether the patient is a smoker or not and whether they are keen to quit, but ideally should cover more detailed data such as how long they have smoked and if they have ever tried to give up in the past. By collecting this sort of information it is possible to help patients identify the best means of quitting.

Advise

Every smoker must be told of the value that stopping smoking will have for them and of the dangers that exist in continuing. Because the needs and reasons for wanting to stop will be different for every smoker, it is important to examine each individual situation and give plain, precise and personalised advice to them. This can include recommending aids to stopping smoking such as using Nicotine

Replacement Therapy (NRT) or Zyban (bupropion).^[59] By making clear (though not over-stressing) the risks associated with smoking it is possible to give reasons that will reinforce their decision to stop - most smokers are aware of the dangers that tobacco poses, but the majority of them do not appreciate the true extent to which smoking is destroying their health. Reasons for quitting will obviously vary for different groups of smokers but might include the following:

- Pregnant women: Increased risk of low birth-weight and foetal death.
- Long-term smokers: Increased risk of heart disease, cancer and stroke.
- New smokers: Easier to stop now than later.
- Any smoker: Save money and feel healthier.

Giving up smoking is the best thing that smokers can do to improve the state of their health and many of them will have tried to stop in the past. Dentists should stress that those people who have tried to give up in the past fair much better when trying to quit again.

Assist

Dentists and other clinical staff should be encouraged to help any smoker who wants to stop. This could be done in something as simple as a five minute advice session, during which time various topics can be covered and essential practical advice can be given. General points to consider could include:

- Set a date for quitting and stop entirely on that day.
- Perhaps recommend NRT or Zyban.
- Call the smoking helpline:- England / Wales: 0800 169 0169
 - Scotland: 0800 84 84 84
 - N. Ireland: 028 9066 3281

or the Asian helplines:

- Bengali: 0800 169 0885
- Gujarati: 0800 169 0884
- Hindi: 0800 169 0883
- Punjabi: 0800 169 0882
- Urdu: 0800 169 0881

- Get friends and family involved to help.
- Plan ahead so that any problems that may arise can be dealt with.
- Have "substitutes" to smoking arranged, such as gum or exercise.

Arrange

The role of the dentist in helping people to give up smoking does not end with an advice session. Arranging a follow-up is important, preferably within 1-2 weeks of quitting. This may fit in with a subsequent dental appointment or a visit to the hygienist. Patients may also be referred to local smoking cessation services and helplines. This is important since studies show that people are twice as likely to successfully quit with regular follow-ups than without.⁵⁸ Even with routine contact, most smokers will make three or four attempts to quit before they finally succeed, so it is important that they understand that relapse is perfectly normal, but at the same time not be put off trying to quit again and again if necessary.

To help smokers overcome nicotine cravings, dentists can recommend following the "Four Ds", aimed at reducing the urge to smoke:

- DELAY: Don't act on the urge to smoke by opening a pack or lighting a cigarette because even after a few minutes this urge will reduce.
- DEEP BREATHS: Take three deep, slow breaths in and out.
- DRINK WATER: Sip it slowly and enjoy the taste.
- DO SOMETHING ELSE: Take your mind off smoking by doing some exercise, listen to music or talk to a friend.

For those people who have tried repeatedly to quit and have failed, it may be necessary to refer them to a cessation specialist, where further help can be given.

Conclusion

The dangers posed to oral health from smoking and chewing tobacco are well documented within the dental profession but the public's lack of knowledge on the subject is exceptionally worrying. Dentists are eager to disseminate information on the subject as widely as possible and improve existing screening programmes to ensure that the public is made aware of these risks, especially those within

high-risk groups. Given that in general the effects of many oral diseases are reversible, and more specifically that the survival rates for early diagnosed oral cancers are high, gives much ground for future optimism. However it is vital that more is done to ensure that public awareness of tobacco related oral diseases continues to improve and more people are regularly screened. The combination of providing opportunistic advice, particularly to stop smoking, together with regular screening will reduce the overall morbidity and mortality from oral cancer and other mouth disorders, and will dramatically improve the quality of life of those people who are at greatest risk of these diseases.

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