



September 2016

# Tobacco and Oral Health

research report **ash.**  
action on smoking and health

## The health effects of tobacco use on oral health

Smoking and chewing of tobacco products have a number of well documented detrimental effects on the oral cavity. These include aesthetic changes such as stained teeth and the need for dentures, as well as much more serious complications including an increased risk of periodontitis leading to tooth loss, bone loss and impaired wound healing, reduced taste sensation and halitosis (“bad breath”). The most serious condition associated with smoking and tobacco use is oral cancer. This research report details the effects on oral health of both smoked and smokeless tobacco.

### Aesthetic

The smoking and chewing of tobacco products can have a dramatically negative impact on a person’s appearance:



- Smoking and chewing tobacco stains and discolours teeth, dentures and restorations.<sup>1,2,3</sup> The extent of staining depends on the duration and frequency of the habit and oral hygiene of the individual. In general, smokers have twice as much tooth staining as non-smokers.<sup>4</sup> Reductions in discolouration can be achieved through the use of nicotine gum as an adjunct to smoking cessation.<sup>5</sup> Nicotine gum contains active ingredients present in tooth-whitening products and the act of chewing gum itself is associated with mechanical removal of debris.<sup>5</sup>
- Cross-sectional and longitudinal epidemiological studies conducted among various populations have shown a relationship between tobacco use (in the form of cigarettes, pipes and smokeless tobacco) and increased tooth loss.<sup>7,8,9</sup> A large study of over 23,000 adults in Germany found that the risk of tooth loss was greatest among heavy smokers (>15 cigarettes per day) and that smoking cessation was associated with a reduction in the risk of tooth loss, with the risk approaching that of never smokers after 20 years of abstinence.<sup>10</sup>
- Pipe smokers and smokeless tobacco users are prone to excessive wear on their teeth, which often become flat. The eventual exposure of tooth dentine can lead to deep tobacco staining.<sup>11,12</sup>
- Tobacco, whether smoked or chewed, can cause halitosis.<sup>1,13</sup> Tobacco-associated bad breath is related to the strength of tobacco smoked. Pipes and cigars 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 sugar and citric acid contained in them.<sup>14</sup>

- Smoking has also been implicated in decreasing olfactory sensitivity.<sup>15</sup> In one study, taste impairment was observed in 18% of light smokers and 28% of heavy smokers.<sup>16</sup> There is uncertainty as to whether there is a return to normal after stopping smoking and how long it takes.<sup>17</sup>
- Cleft lips and palates are twice as common amongst children born to mothers who smoked during pregnancy.<sup>18,19</sup> A dose response exists, such that higher levels of maternal smoking are associated with a greater risk.<sup>19</sup>
- Smokers have higher levels of calculus formation than non-smokers. Calculus, also known as tartar, is a form of hardened dental plaque. The rough surface of calculus enables more plaque to stick to teeth and cause gum disease and cavities to form.<sup>13</sup> Males have significantly more plaque than females and in both genders, smokers have almost twice the percentage as non-smokers.<sup>20</sup> Plaque appears to be more adherent to the tooth and less frequently removed from the teeth of smokers due to the deposition of tar from smoke.<sup>21</sup> It may also be the case that smokers have less adequate oral hygiene habits than nonsmokers.<sup>22</sup>

### Dental implants

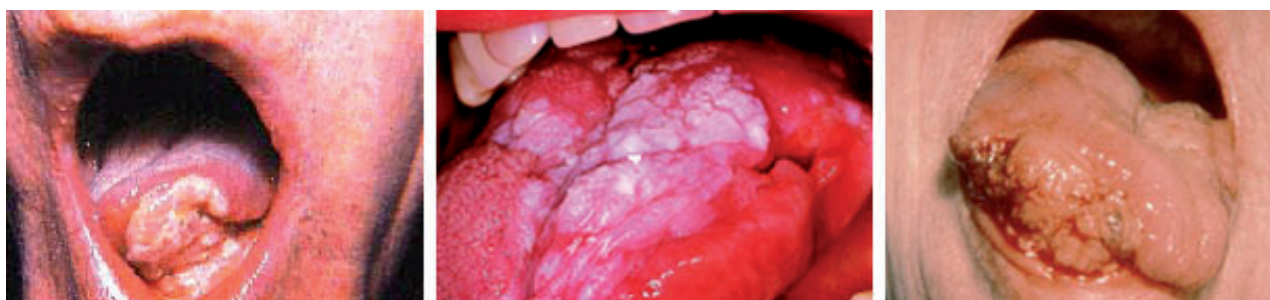
Recent meta-analyses have observed that smoking is associated with a higher risk of dental implant failure.<sup>23,24,25</sup> Failures of implants inserted in smokers are 2 times more likely to happen than failures of implants inserted in non-smokers.<sup>24</sup>

### Heart disease

The 2010 Scottish Health Survey found that poor oral hygiene was associated with higher levels of risk for cardiovascular disease.<sup>26</sup> Researchers concluded that periodontal disease, a chronic infection of the tissues surrounding the teeth can lead to raised levels of C reactive protein which is an indication of systemic inflammation. It is believed that systemic inflammation could represent the underlying link between cardiovascular disease and poor oral health. Non-causal pathways have included discussions of a potential genetic pro-inflammatory susceptibility that increases the risk of both conditions. Smoking is strongly associated with periodontitis.<sup>1</sup> (See Periodontal Disease below)

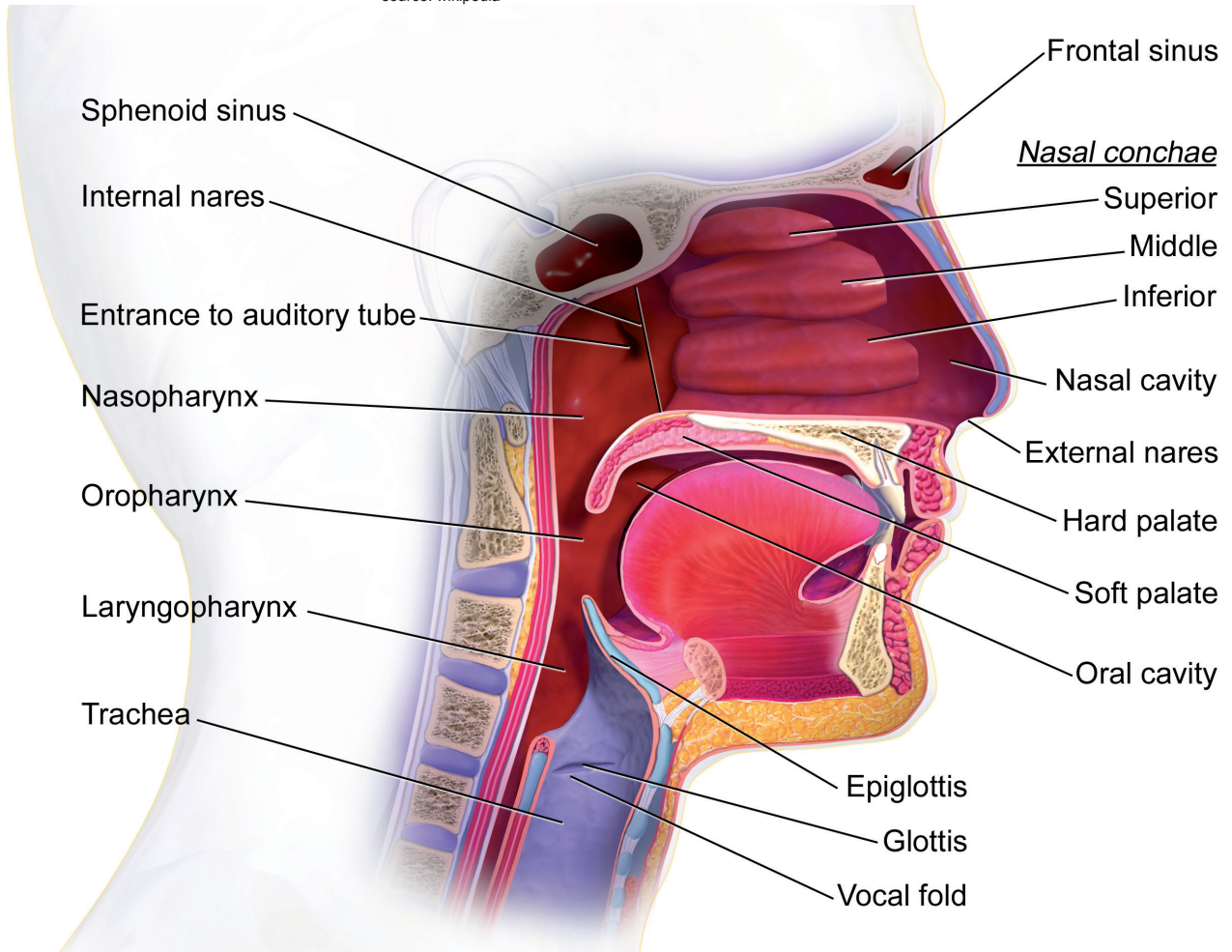
### Oral cancer

In England in 2013, 7,591 individuals (4,071 men and 2,137 women) died from oral cancer. Based on the International Classification of Diseases (ICD) oral cancer includes all cancers of the lip, tongue, mouth, oropharynx, piriform sinus, hypopharynx and other and ill-defined sites of the lip, oral cavity and pharynx (ICD10 codes: C00-06/C09-10/C12-14).



## Upper respiratory system

source: wikipedia



Cancer Research UK cites the following risk factors for oral cancer:

- Smoking tobacco – cigarettes, pipes and cigars
- Smokeless tobacco– e.g. snuff, gutkha,
- Betel quid – with or without tobacco
- Excessive alcohol consumption
- Prior history of oral / aerodigestive cancers
- Age – Increasing age is a risk but oral cancer can occur at any age
- Poor diet - deficiencies, especially of certain minerals and vitamins including A, C and E; Beta carotene is protective
- Sun exposure (especially for lip cancer)
- Human papillomavirus and immunosuppression
- Potentially malignant oral disorders.<sup>30</sup>

The US Surgeon General concludes that tobacco use in any form is one of the major causes of oral cancer, accounting for more than 90% of cases.<sup>31</sup> The most common place for oral cancers to occur are the tongue (20%), the gingiva (gums) (18%), floor of mouth (12%), lip (11%) and salivary gland (8%).<sup>32</sup> Cigarette smokers have over a three-fold increased risk of oral cancer compared to individuals who have never smoked.<sup>33,34</sup> For long-term regular users of smokeless tobacco this risk is even greater.<sup>35,36,37</sup> Oral leukoplakia is the most common form of potentially malignant disorder in the oral cavity. It is estimated that three out of every four users of smokeless tobacco will develop an

oral leukoplakia at the site where they hold the tobacco product in their mouth.<sup>38</sup> A case-control study of smokeless tobacco use amongst South Asians also found a significantly increased risk of oesophageal cancer associated with the use of areca nut and betel quid when used with chewing tobacco.<sup>39</sup>

NICE Guidance published in September 2012 included recommendations for the commissioning of smokeless tobacco services and providing brief advice and referral (from dentists, GPs and pharmacists).<sup>40</sup>

Cigar and pipe smoking is also associated with increased risk of oral, lip, oesophageal and pharyngeal cancers.<sup>41</sup>

The smoking associated risk of oral cancer is both dose and duration dependent, such that those who smoke the most amount of cigarettes for the longest period of time have the greatest risk. However, even low frequency cigarette consumption (1-3 cigarettes per day) is associated with the development of head and neck cancers.<sup>42</sup>

Smoking cessation reduces the risk of oral cancer.<sup>1</sup> However, there is some evidence to suggest that it may take at least twenty years for the risk to fall to that of never smokers.<sup>43</sup>

### **Oral mucosal diseases**

Tobacco use is associated with a range of changes to the oral mucous membrane cells. 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. A national cohort study in the US concluded that smokeless tobacco users had the highest incidence of nicotinic stomatitis.<sup>44</sup> Smoker's palate is also commonly seen in pipe smokers, but is rarer in cigar and cigarette smokers. Changes are generally related to the heat generated from smoke. This condition is reversible following smoking cessation.<sup>45</sup> Nicotinic stomatitis is estimated to contribute to over 40% of all oral lesions in older adults, followed closely by denture stomatitis (34%).<sup>46</sup>
- **Smoker's melanosis:** Smokers are more likely to develop local areas of melanin pigmentation of their mucous membranes.<sup>47</sup> The condition is not pre-malignant and is reversible after quitting smoking.<sup>48</sup> Tobacco-associated melanin pigmentation has been reported in 22% of smokers and is dose-dependent.<sup>49</sup> These manifestations in pigmentation are considered normal and generally no treatment is recommended except for aesthetic purposes.<sup>50</sup>
- **Oral Candidosis:** This is a mucosal infection caused by the candida albicans fungus. Smoking is a risk factor for this infection but the mechanism is not fully understood.<sup>51</sup> It has been suggested that tobacco use may depress the immune system, making smokers more susceptible to infection.<sup>51</sup> While some studies have suggested that smoking does not affect candida carriage significantly,<sup>52,53</sup> earlier studies reported that it does significantly increase prevalence.<sup>54,55</sup> Smoking has been found to be an independent risk factor for oral candidosis among HIV infected adults.<sup>56,57</sup>

## Periodontal diseases

Periodontal diseases are inflammatory disorders of the periodontium (the tissue which surround and support the teeth) and include gingivitis, which affects the gums, and periodontitis, which may involve all structures and bone supporting the teeth. A recent review of the epidemiological patterns of periodontitis reported a range in prevalence of severe periodontitis from 1% among 20-29 year olds to 39% among individuals >65 years of age.<sup>58</sup>

Tobacco smoking is a risk factor associated with chronic destructive periodontal disease and can lower the chances of successful treatment.<sup>59,60</sup> The likelihood of developing increasing periodontal disease exhibits dose dependency.<sup>61</sup> It has been estimated that a smoker has between a 5 fold and 20 fold increased risk of periodontal disease.<sup>59</sup>

- The risk of alveolar bone loss is seven times greater amongst smokers than non-smokers.<sup>62</sup>
- There is some evidence to suggest the effect of tobacco use on periodontal tissues is more pronounced in male smokers than female.<sup>63</sup>
- Smokers exhibit higher rates of tooth loss than non-smokers.<sup>59</sup>
- Smokers have decreased levels of salivary and serum immunoglobulins which impairs their ability to fight the bacteria in the oral cavity. Smoking also alters the cells that attack bacteria which affects a smoker's ability to clear pathogens.<sup>31</sup>

There is also evidence that smokeless tobacco is a cause of periodontal disease.<sup>64,65</sup> Studies conducted in the US, India, Bangladesh and Thailand have reported that oral smokeless tobacco users tend to have higher risk of periodontal disease.<sup>66,67,68,69,70,71</sup> However, some studies have failed to find such associations between smokeless tobacco use and periodontal changes including gingival recession, attachment loss and bone loss.<sup>72,73</sup>

There is good evidence to suggest that quitting smoking reduces the risk of periodontal disease.<sup>74</sup> However, it can be many years before a former smoker's risk of tooth loss falls to that of a never smoker.<sup>75</sup>

## Dental caries

Dental caries is the medical name for tooth decay but also refers to the manifestation of a bacteria which causes the decay.<sup>31</sup> Dental caries is present in both low- and high-income countries and, worldwide, affects around 60-90% of children and nearly almost all adults.<sup>76</sup> The US Surgeon General's 2000 Report "Oral Health in America" concluded that tobacco use was a risk factor for dental caries and recommended that dental healthcare professionals include smoking cessation counselling as part of their health promotion work in the prevention of dental caries.<sup>31</sup> There is also some research which suggests that exposure to secondhand smoke in the home might increase the risk of dental caries in children.<sup>77,78</sup> Exposure to tobacco smoke at 4 months of age is associated with a twofold increased risk of caries.<sup>79</sup> Maternal smoking during pregnancy has a weaker effect. [79] A systematic review concluded that tobacco smoking is associated with dental caries but the quality of evidence to date is poor.<sup>80</sup> The association between smoking and dental caries has been explained by poor oral hygiene and harmful dietary habits associated with smoking behaviour.<sup>81,82,83</sup>

## Wound healing

Tobacco use is known to impair wound healing.<sup>84,85</sup>

- Smokers have decreased levels of salivary and serum immunoglobulin which affects wound healing in the oral cavity and the mouth's ability to clear pathogens.<sup>31</sup>
- Smokers have decreased blood oxygenation leading to decreased oxygen delivery to the tissues,<sup>86</sup> which also impairs healing following oral surgery.
- The loss of the blood clot that follows the removal of teeth (referred to as dry sockets or localised osteitis) occurs four times more frequently in smokers than in non-smokers.<sup>87</sup>
- There is also evidence which suggests that smoking inhibits healing through the effects of decreased oxygenation in the blood and tissues, and constriction of blood vessels.<sup>88</sup>

Wound healing is improved following smoking cessation.<sup>89</sup>

## Second-hand smoking

Second-hand smoking, also known as passive smoking, is defined as inhalation of the cigarette smoke of another individual or the exhalation of a smoker. The association of secondhand smoke with lung cancer, cardiovascular diseases and sudden death syndrome is firmly established.<sup>90,91,92</sup> Environmental smoke contains over 4000 chemicals which also adversely affect the oral health of passive smokers.

Secondhand smoke causes upper airway infection, decreases alveolar bone density,<sup>93</sup> periodontitis,<sup>94</sup> implant failure,<sup>95</sup> gingival pigmentation, tooth decay<sup>96</sup> and tooth loss. Passive smoking is also a risk factor for facial clefts,<sup>97</sup> delayed tooth development<sup>98</sup> and implant failure, with a 2.3 times bigger risk among those who are exposed compare to those not exposed to passive smoking.<sup>95</sup>

There is some evidence to suggest that exposure to secondhand smoke may increase oral cancer.<sup>99,100</sup>

Increasing the knowledge of smokers about the oral and dental problems caused by indirect exposure to cigarette smoke may encourage them to quit smoking.

## Synergistic effects with alcohol

Tobacco smoking and alcohol use play an etiological role in oral cancer development. Various studies have shown that a causative relationship exists between oral cancer and the heavy intake of alcohol and that the combination of tobacco and alcohol use raises the risk for oral cancer significantly more than the use of either substance alone.<sup>101,102</sup> The joint effect of both behaviours is two to three times greater than the individual effects of smoking and drinking.<sup>103,104,105</sup> Heavy drinkers who also smoke have 38 times the risk of oral cancer compared to non-smokers who do not drink.<sup>106</sup> Alcohol increases the permeability of the oral mucous membranes which is thought to enhance the carcinogenic effect of tobacco based products.<sup>107</sup>

It has been estimated that smoking and drinking combined account for about 75% of all oral and pharyngeal cancers in the United States.<sup>106</sup> There is also evidence for a possible

synergistic effect with dietary factors. For example, the odds of squamous cell carcinoma of the oesophagus and oral/pharyngeal cancer is higher among those with low vitamin D intake, and even greater among those with low vitamin D intake who are heavy current smokers and consumers of alcohol.<sup>108</sup>

## What can be done?

Dental and healthcare professionals have a crucial role to play in raising awareness of the dangers to oral health associated with smoking and the use of smokeless tobacco.<sup>109,110</sup>

### Smoking cessation

Reducing tobacco use is a key Government priority<sup>111</sup> and an important component in 'Delivering better oral health'.<sup>112</sup> Dental teams have a key role in identifying smokers and tobacco users; providing information on reducing risks; and onward referral for smoking cessation services.<sup>113</sup> Around 61% of adults in England attend the dentist for a regular check-up, 10% do so on an occasional basis and 27% when they have trouble with their teeth.<sup>114</sup> Thirteen per cent of women who smoke during pregnancy access free dental treatment.<sup>115</sup>

A Cochrane systematic review concluded that brief advice in addition to personalised feedback following an oral examination by dental staff increased tobacco abstinence rates among both cigarette smokers and smokeless tobacco users.<sup>116</sup> Surveys indicate that dental teams have an increasingly positive attitude towards tobacco cessation and are becoming more actively involved in the care pathway.<sup>117</sup> Dentists have also been found to more accurately predict tobacco use than other health-care professionals.<sup>118</sup>

Consequently, NICE Guidance "Brief interventions and referral for smoking cessation in primary care and other settings" includes dentists in the list of healthcare professionals who should be offering routine stop smoking advice.<sup>119</sup> Such brief interventions have been found to increase quit rates by 1-3%.<sup>120,121</sup>

The National Centre for Smoking Cessation and Training ([NCSCT](#)) has developed a simple form of advice designed to be used opportunistically in less than 30 seconds. It is called very brief advice and has three elements:

- *Establishing and recording smoking status (ASK)*  
All patients should have their tobacco use established and checked at least once per year (current/ex-smoker/never smoker)
- *Advising on the personal benefits of quitting (ADVISE)*  
Having established that an individual smokes, they should be informed about the dangers and advised to stop.
- *Offering help (ACT)*  
All smokers should receive advice about the benefits of attending their local stop smoking services. Stop smoking services provide evidence-based treatment in the form of pharmacotherapy and behavioural support and are one of the most-cost effective interventions.<sup>122,123</sup>

### Harm reduction

Giving up smoking is the best thing that smokers can do to improve their health and many of them will have tried to stop in the past. Dentists should stress to patients who have made unsuccessful quit attempts that it is common to make several attempts before succeeding.



For smokers who are not ready or willing to stop, dental staff should recommend that they consider using a licensed nicotine containing product to help them reduce their smoking. The NICE guidance “Tobacco: harm-reduction approaches to smoking (PH45)” provides the following advice:

- Individuals are addicted to the nicotine in cigarettes, but it is the other components of tobacco which causes the harm.
- Licensed nicotine-containing products are an effective way of reducing the harm from tobacco for smokers and those around them.
- It is safer to use licensed-nicotine containing products than to smoke.
- People who wish to reduce the amount they smoke can use licensed nicotine products to provide them with some ‘therapeutic’ nicotine.<sup>124</sup>

Clinical trials have shown that the use of nicotine replacement therapy as an aid to smoking reduction can increase the propensity of smokers to quit and result in significant reductions in cigarette consumption.<sup>125</sup> However, at a population level, due to poor compliance with recommendations, similar declines in harm are not found i.e. those who do and do not use nicotine replacement therapy for cutting down smoke a similar number of cigarettes per day.<sup>126</sup> Smokers should also be aware that quitting smoking abruptly is more likely to lead to lasting abstinence than cutting down first, even for smokers who initially prefer to quit by gradual reduction.<sup>127</sup>

## Conclusion

The dangers posed to oral health from smoking and chewing tobacco are well documented within the dental literature but the public’s lack of knowledge of the risks is a concern. Dentists are encouraged 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. 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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