A review of the role of alcohol in the pathogenesis of oral cancer and the link between alcohol-containing mouthrinses and oral cancer

Précis

The link between alcohol-containing mouthrinses and oral cancer is investigated, concluding that limited use of alcohol-containing mouthrinses in high-risk populations would be advisable.

Abstract

This article will review the most recent literature on the effects of alcohol on the oral mucosa, and the possible mechanisms by which alcohol is thought to act as a carcinogen. The article will also consider the possible link between alcohol-containing mouthrinses and oral cancer. The authors recommend that the use of alcohol-containing mouthrinses in high-risk populations should be restricted, pending the outcome of further research.

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Introduction

Alcohol consumption is a significant risk factor for the development of oral cancer,[1,2] in addition to other cancers of the head and neck such as pharyngeal and laryngeal cancer.[3,4] However, the precise role of alcohol in the pathogenesis of the disease is not fully understood. Not all oral cancer patients consume alcohol, while not all people who drink alcoholic beverages develop oral cancer.[5] Smoking and alcohol consumption are synergistic risk factors for oral carcinogenesis, further complicating the specific role of each,[5-7] with approximately 75% of all oral cancers arising in association with both alcohol and tobacco use.[2,7] Measurement of alcohol intake is also difficult to quantify, with patient subjectivity and variation in quantity, type and alcohol concentration existing between patients, which further complicates investigating the role of alcohol in oral cancer.[8]

Constituents of alcoholic drinks

The alcohol family is comprised of three main members: methanol, propan-2-ol and ethanol.[9] Methanol and propan-2-ol are toxic to consume,[9] while ethanol, in addition to water and glucose, is the main constituent of alcohol-containing beverages.[8] Alcoholic beverages may also contain certain carcinogenic impurities. These include N-nitrosodiethylamine in some beers and whiskeys, and polycyclic aromatic hydrocarbons in some whiskeys.[8]

Carcinogenic effects of ethanol

Ethanol consumption can act as a risk factor in the development of oral cancer.[10] Local effects of ethanol include:

- Increases in mucosal permeability to other toxins and carcinogens;[8,10,11,12]
- altered mucosal morphology with a reduction in epithelial thickness;[13,14,15]

- acetaldehyde (the first metabolite of ethanol) is a mutagenic and carcinogenic substance,[16,17] which causes cellular damage to the oral epithelial cells;[10]
- ethanol may potentiate the carcinogenic effects of other agents;[5] and,
- ethanol disrupts salivary gland function,[18] reducing the clearance of locally acting carcinogens and thus increasing the risk of cancer development.[10,19]

Alcohol-containing mouthrinses and oral cancer

Mouthrinses are used for the treatment of a variety of oral conditions, ranging from the management of halitosis to the treatment of oral infections.[20] Ethanol is used as a solvent for the active agents in many mouthrinses, with concentrations ranging from 6-26.9%.[20] The advantages of using ethanol in a mouthrinse include its antiseptic and preservative properties, its low cost and ease of production.[21]

A possible harmful effect of alcohol-containing mouthrinses has been suggested. This is because these mouthrinses contain high concentrations of ethanol, and are kept in the mouth in direct contact with the oral mucosa for relatively long periods.[22] Some of the suggested adverse effects include an increased risk of developing oral cancer, as well as causing a burning sensation in the mouth, drying of the oral mucosa and softening effects on composite filling materials.[21]

A recent meta-analysis of the relationship between alcohol-containing mouthrinses and oral cancer by La Vecchia in 2009 concluded that a link between the use of alcohol-containing mouthrinses and oral cancer is not supported by epidemiological evidence.[23] Reviews by Cole *et al*. in 2003 and Elmore and Horowitz in 1995 also concluded that the available epidemiological evidence did not support a link between alcohol-containing mouthrinse use and oral cancer.[3,24]

In addition, a population-based case-control study of oral cancer in Puerto Rico by Winn *et al*. in 2001 did not provide any evidence of increased risk associated with the use of alcohol-containing mouthrinses.[25]

However, the results of other studies are in conflict with these conclusions. A review article by McCullough and Farah in 2008 concluded that there is sufficient evidence to indicate that the risk of developing oral cancer is increased with the use of alcohol-containing mouthrinses.[26] They recommended that alcohol-containing mouthrinses should be restricted to short-term use. Two multi-centre case-control studies conducted in 2007 in Central Europe and South America also found that the use of alcohol-containing mouthrinses twice daily significantly increased oral cancer risk among current and former smokers and drinkers, as well as among lifelong alcohol abstainers.[27]

Lachenmeier *et al*. in 2009 found that the acetaldehyde content of saliva following mouthrinse use was significantly above physiological levels. This was found to be equivalent to levels of acetaldehyde detected in saliva following alcoholic beverage consumption.[28] Poggi *et al*. in 2003 advised against the use of alcohol-containing mouthrinses, due to acetaldehyde accumulation in the mouth following their use.[29]

Conclusion

The relationship between alcohol consumption and oral cancer is complex. Oral cancer is a disease whose multifactorial nature results in difficulties in determining the precise role of each agent independently. However, the evidence supporting the role of alcohol in the aetiology of oral cancer is convincing, with a significant proportion of oral cancer cases attributable to heavy alcohol consumption.[7] This illustrates the need for increased public awareness campaigns to reinforce the harmful effects of chronic heavy alcohol consumption.

Evidence regarding the carcinogenic effect of alcohol-containing mouthrinses is inconsistent, and a link between the use of alcohol-containing mouthrinses and the development of oral cancer has not yet been firmly established. Nevertheless, considering what is known about the local effects of ethanol on the oral mucosa, it may be prudent to limit their use, particularly in high-risk patients such as smokers.

The authors recognise the difficulty in isolating alcohol as an independent factor in the pathogenesis of oral cancer. Considering the continually increasing use of alcohol-containing mouthrinses in certain populations, there is potential for further research to be conducted on a broader scale.

It is hoped that the outcomes of this review will allow clinicians to provide the public with informed advice on the harmful effects of alcohol exposure.[30]

Acknowledgements

For further information on alcohol and oral cancer, please see 'A review of the relationship between alcohol and oral cancer', published online in *The Surgeon* on February 22, 2011.[30]

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