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This series aims to enhance the healthcare team's awareness of the importance of early detection by recognizing signs and symptoms of orofacial cancers and their management, and of prevention. It discusses treatment complications from surgery, radiotherapy (RT) and chemotherapy (CTX), summarizing the outcomes of a meeting on 'Oral Healthcare in People Living with Cancer' held in 2010, attended by 300 delegates from 33 countries – dentists, specialists, and Dental Care Professionals (DCPs), and the cancer support team. There is a considerable body of literature on oral cancer but very little is written on healthcare aspects of people living with cancer and a particular focus of this meeting was caring for survivors. The Faculty included European leaders in the field who have authored the series. The full peer-reviewed papers from the meeting are published in Oral Oncology 2010; 46; 485–570.

Oral Cancer: Comprehending the Condition, Causes, Controversies, Control and Consequences

16. Infections

Oral cancer and its treatment can cause a variety of oral problems. Surgery and scarring may mutilate tissues – which can hamper function and cleaning the teeth. The patient may have complicated reconstructive structures that need special attention. Therapy-induced hyposalivation impedes salivary protection. Cytotoxic drugs affect both the local and systemic defensive factors leading easily to persistent or masked infections. Consequently, infections such as dental caries, gingivitis, candidosis and sialadenitis become issues.

Hence every effort should be focused on prevention. Daily self-care of oral hygiene is fundamental in maintaining satisfactory oral and dental health. In this, the cancer patient often needs hands-on advice regularly controlled by the dentist or dental hygienist. These patients also need frequent dental appointments based on their individual needs.

In caries prevention, intensive fluoride therapy together with dietary counselling is needed. Oral cancer patients also need to be frequently referred to dental hygienists for professional cleaning. In oral candidosis, and in sialadenitis, the microbiological diagnosis must be confirmed

- Dietary counselling with emphasis on the restriction of intake of sugar and other fermentable carbohydrates. Avoid drug preparations sweetened with fermentable sugars.
- Fluoride toothpaste used twice daily. Preparations without sodium lauryl sulphate used to avoid mucosal irritation. Daily use of 0.05% sodium fluoride solution or other commercial low-fluoride products without mucosa-irritating components is recommended. Additional fluoride for select patients, eg weekly application of 0.2% fluoride gel in individually made mouthguards or professionally applied fluoride varnish.
- Commercial remineralization products such as calcium phosphate-containing tablets and lozenges or casein phosphopeptide preparations used daily
- Xylitol chewing gums and other high-content xylitol products used daily.
- Attention on maintaining good daily oral hygiene practices, including cleaning inter-dentally. A powered toothbrush is often of help.
- Daily or more frequent aqueous chlorhexidine mouth rinsing.
- Professional tooth cleaning at individually assessed intervals.
- Salivary mutans streptococci assays for assessment of caries risk. For patients heavily colonized ($\geq 10^6$ cfu/ml saliva) treatment with eg chlorhexidine (1%) gel in individually prepared mouthguards for two weeks every three months, or professionally applied chlorhexidine varnish.

Based on the 2009 guidelines of a joint working group of the Finnish Medical Society Duodecim and the Finnish Dental Society Apollonia, and followed by the Helsinki University Central Hospital (HUCH).

Table 1. Recommendations for caries prevention for oral cancer patients.

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before administration of antimicrobials in order to avoid selecting resistant strains.

A careful dental clinical examination before cancer treatment is essential, in order to target the individual oral health problems properly, to advise the patient about anticipated problems, and to ensure that dental extractions that might be needed are carried out before radiotherapy is started, to avoid subsequent osteoradionecrosis (Article 17).

Of the many problems the patient with oral cancer faces, this paper focuses on dental caries, candidosis and sialadenitis.

Dental caries

Following RT to the head and neck there is often irreversible hyposalivation, predisposing to caries – often for the rest of the patient's life. In several centres, salivary mutans streptococci (the common cariogenic bacterium) counts are monitored regularly in order to target caries-risk patients with intensified prophylaxis.

Patient compliance with preventive protocols may be an obstacle for successful prevention and thus individualized protocols must be emphasized. The most important facet of caries prevention is dietary control,

Prevention of oral candidosis

- Oral hygiene instruction.
- Professional tooth cleaning given regularly by a dental hygienist, based on individually assessed intervals.
- Dental prostheses and other reconstructive structures must be kept clean by mechanical brushing at least twice daily. Chlorhexidine or commercial chemical cleaning preparations are also recommended for cleaning removable dental prostheses.
- In prevention of recurrent *Candida* infections, antifungal agents (see below) may be used for one week every 2–6 weeks.
- Dry mouth preparations are recommended (see Article 15).

Treatment of oral candidosis

- Infection must be verified by culture samples and sensitivity testing.
- Topical antifungal agents are the treatment of first choice. Sugar-free preparations containing amphotericin B eg four times daily for 4–6 weeks are recommended. In persistent infections simultaneous use of other topical drug preparations (eg nystatin, miconazole) is recommended for 5–6 weeks. Alternatively, or in addition to, non-alcohol containing chlorhexidine (1 mg/ml) mouthrinses twice daily for two weeks.
- Systemic antifungal medication is avoided, if possible, because of potential selection of resistant strains.
- Dental prostheses should be treated to avoid recurrent *Candida* infections.

Based on clinical practice at the HUCH.

Table 2. Prevention and management of candidosis (candidiasis) in patients with oral cancer.

minimizing the frequency of intake of cariogenic sugars. In the clinical nutrition of cancer patients, nutritionists balance between patient compatibility and a healthy, energy-rich diet in order to maintain the quality of life and, in such cases, the dental health point of view is not always considered. Nevertheless, the commonly employed dietary guidelines should be individually tailored to every patient with oral cancer.

Strategies include avoiding between-meal snacks and particularly fermentable carbohydrates; avoiding sticky foodstuffs with low oral clearance; and using sugar substitutes when relevant. Xylitol products have been particularly recommended since this sugar substitute also inhibits mutans streptococci. Medicines sweetened with sucrose are best avoided; if there are no alternative preparations available that use sugar substitutes, the patient should be advised to rinse his/her mouth with water after the medication is taken. Patients should also be advised to drink water rather than sugary drinks, or acidic drinks which also easily cause dental erosion.

Erosion can also result from frequent vomiting often seen among patient on cytostatic drugs.

Fluoride prophylaxis is essential in combating caries. Fluoride increases the acid resistance of dental hard tissues and may also inhibit cariogenic oral microbiota.

Various application methods are available but the method of fluoride application is not critical so long as the patient does receive daily topical fluorides and understands the need. Continuous release of fluoride from specially made intra-oral appliances is more effective than conventional topical applications or use of fluoride mouthguards, but these are more readily available.

Calcium phosphate lozenges with xylitol and fluoride have been used both for erosion and caries risk patients. Furthermore, there have been promising results on re-mineralization of initial enamel lesions of caries by the use of amorphous calcium phosphate and casein phosphopeptide, available in a commercial foam preparation and easily self-administered.

Finally, mechanical cleaning the teeth and use of antibacterial/antiplaque agents for controlling oral biofilms is recommended. Aqueous chlorhexidine is the gold standard for chemical plaque control. Table 1 gives recommendations for caries prevention for oral cancer patients.

Candidosis

Oral cancer patients are liable to candidal infections because of hyposalivation, treatment-related immunosuppression, frequent use of antibiotics and sometimes of cytotoxic drugs. The diet may also

favour *Candida* colonization, if fermentable carbohydrates are frequently consumed. The wearing of dental prostheses or obturators also predisposes to infection.

Candidal infection may be difficult to detect clinically but can present as white or red mucosal lesions. Classically, the white lesions will readily wipe off with a gauze, to leave a red base. Microbiological sampling from suspect mucosal lesions or from the labial sulcus is a necessity and the laboratory should be asked to identify the yeasts to the species level. Firm diagnosis is important because antifungal drug resistance is an emerging problem and thus unnecessary treatments should be avoided.

Oral candidosis is usually readily treated with topical antifungal preparations such as amphotericin, nystatin, or miconazole. Probiotics (health-beneficial bacteria) may also inhibit oral *Candida*. Finally, if the patient has dental prostheses these need to be treated as well since, in oral cancer patients, they are almost invariably colonized with *Candida*. Table 2 gives guidelines for the prevention and management of oral candidosis.

Sialadenitis

Irradiation and cytostatic drugs lead to sialadenitis (sialoadenitis) which, in turn, may lead to irreversible hyposalivation which, with poor general health, renders cancer patients liable to ascending infective (bacterial) sialadenitis, mainly involving *Streptococcus viridans* and *Staphylococcus aureus* (often penicillin-resistant), ascending from the oral cavity.

The parotid glands are most commonly affected, and sialadenitis may present as a painful salivary gland swelling, the overlying skin possibly reddened, pus exuding from, or milked from the parotid duct orifice and sometimes with trismus, lymphadenitis and fever. It is an acute parotitis typically affecting one gland only. The management of sialadenitis often means hospitalization of the patient and includes:

- Analgesia and prompt treatment with amoxicillin (flucloxacillin or amoxicillin/clavulanate if staphylococci and not allergic to penicillin; erythromycin or azithromycin in penicillin allergy).
- Surgical drainage if there is fluctuation.
- Hydration.
- Salivation stimulation by use of chewing gum or sialogogues.