

Chapter 8

Mouth Care**Overview**

Oral diseases can be serious in people with HIV/AIDS. They require a more aggressive approach to treatment so that a minor problem does not escalate into a major problem with serious health consequences. The early detection and management of oral HIV-related conditions can considerably improve a patient's quality of life. Also, oral lesions and symptoms can be used as markers of worsening immune suppression and HIV disease progression.

Palliative care interventions for HIV-related oral symptoms are often disease-specific, as in the use of antifungal medication for the symptoms of oral candidiasis or antiviral medication for herpes simplex stomatitis. Other symptoms, such as pain or xerostomia, may be treated effectively with palliative medications.

Many of the oral problems that develop can be treated by health care workers (HCWs) rather than oral or dental specialists. In fact, in most resource-limited settings dentists and other oral health specialists are scarce and only consulted for preventive care by the wealthy. HCWs should conduct thorough oral examinations to identify common conditions requiring palliative care and to encourage good mouth care, which is the best prevention measure. Where dental or oral specialists are available, patients should be referred when further care is necessary.

The oral manifestations of HIV infection include fungal, viral, and bacterial infections as well as opportunistic cancers. This chapter addresses prevention of oral problems through good basic mouth care, the palliative management of oral pain, and the most common oral health issues facing people with HIV/AIDS in sub-Saharan Africa.

Authors

Deborah Anne Norval

Vanessa Adams

Sudeshni Naidoo

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Preventive Mouth Care

Assessment

Although prevention of HIV-related oral health problems is best achieved by regular visits to an oral health care worker, this is not usually possible in sub-Saharan Africa. The HCW also should thoroughly examine the oral cavity at each check-up visit, including inspection of the tongue, cheeks, palate, gums, and teeth, looking for growths, abnormal mucosa, lesions, and tumours.

Most patients cannot afford dentures, managing well with their gums when they lose their teeth. Patients who do have dentures need careful assessment. Dentures may no longer fit properly due to severe weight loss, making eating, chewing, and talking difficult. Patients may also develop denture stomatitis, which needs to be treated with antifungal agents (see section on oral candidiasis for treatment).

Management

Non-pharmacologic management

Teach patients the basics of good mouth care (see Table 8.1).

If available, consider the following:

Where available, refer to oral health care providers when needed.

Advise patients with dentures on proper denture care (see Table 8.2).

Refer denture patients with ill-fitting dentures to oral health care providers.

Table 8.1: Five Basic Steps to Good Mouth Care

Advise patients to:	
1	Take regular sips of water to keep up fluid intake.
2	Keep lips clean, soft, lubricated, and intact as far as possible. Regularly apply petroleum jelly or moisturising lotion to lips.
3	Brush teeth with a chew stick or a small, soft toothbrush (a baby's toothbrush is ideal) after each meal and at night. If available, use fluoride toothpaste. If brushing is not possible due to pain or bleeding, use soft sponges, cotton buds, or a gloved finger wrapped with gauze or a soft cloth.
4	Use a mouthwash after each meal and at night (in addition to brushing, not as a substitute). Avoid mouthwashes that contain alcohol as it dries out the mouth. Rinse with 15 mL for 60 seconds if possible. Suggestions for mouthwash: <ul style="list-style-type: none"> • Saline: 1 teaspoon salt in 500 mL boiled, cooled water • Sodium bicarbonate mouthwash: 1 teaspoon in 500 mL boiled, cooled water • Vinegar or lemon juice: 1 teaspoon in one litre of boiled, cooled water Antimicrobial mouthwashes: <ul style="list-style-type: none"> • 0.2% chlorhexidine gluconate mouthwash (do not use at the same time as nystatin or amphotericin B) • 1% povidone-iodine mouthwash (has been known to stain the teeth)
5	Check the mouth, cheeks, palate, gums, tongue, and teeth often to identify and manage any problems early.

Table 8.2: Denture Care

Advise patients to:	
1	Clean dentures thoroughly after every meal to remove all food particles and plaque.
2	Disinfect dentures regularly with a denture-cleaning solution.
3	Remove dentures before sleeping.
4	Store dentures in water or a denture sterilising solution.

Palliative Management of Oral Pain

Assessment

All forms of inflammation, infection, or ulceration of the mucous membranes of the mouth can be painful and, in some cases, extremely painful. If severe, patients may be unable to eat, drink, or take oral medications. They are at risk of dehydration, malnourishment, systemic infections, haemorrhage, and depression.

Although diagnosis and treatment of the underlying cause of pain is important, the pain itself should also be acknowledged and actively managed along with treatment of underlying causes.

Management

Pharmacologic Symptom Management

For mild to moderate pain, administer mouthwashes containing analgesic or anaesthetic agents if available, with or without systemic analgesics (see Table 8.3).

Refer to Chapter 4 for pain management according to the WHO 3-Step Analgesic Pain Ladder. Treat severe pain not responding to paracetamol or NSAIDs by adding weak or strong opioid analgesics. If necessary, use subcutaneous or parenteral morphine until a patient is able to swallow again.

Table 8.3: Topical Analgesic and Anaesthetic Preparations to Use if Available

Agent	Mode of Delivery	Dose and Directions
Local Anaesthetics		
Lidocaine	2% viscous	Rinse and expel 15 mL 4 hourly
	10% spray	2 sprays 2–3 hourly
	gel	Apply to affected area as required
Benzylamine hydrochloride, benzocaine	mouthwash	15–30 mL 3–4 hourly
	lozenges	Suck 1–2, 3 times daily as required
	spray	2 sprays 2–3 hourly
Corticosteroids (for painful aphthous ulceration)		
Triamcinolone	0.1% paste	Apply to affected area 8 hourly
Beclomethasone	spray	1–2 puffs twice daily onto ulcer
Prednisolone	5 mg tablet	Place half a tablet against affected area and allow to dissolve
Paediatric corticosteroids	syrup	Swirl around mouth and expel daily
Non-steroidal anti-inflammatory drugs (NSAIDs)		
Benzylamine	0.15% solution	15 mL 4 hourly; rinse and expel
	Ointment	Apply as needed
Salicylate		
Choline salicylate	Gel	Apply with gentle massage 4–6 hourly
Protective/Coating Agents		
Carmellose paste		Apply to affected area
Sucrulfate suspension	Mouthwash	15–30 mL 2–4 hourly; rinse and expel
Oxethazaine, aluminium hydroxide, magnesium hydroxide	Mouthwash	15–30 mL 2–4 hourly; rinse and expel
Solution of equal parts diphenhydramine elixir and kaopectate	Mouthwash	15–30 ml 2–4 hourly; rinse and expel
Solution of equal parts diphenhydramine elixir, aluminium hydroxide, 2% lignocaine	Mouthwash	15–30 ml 2–4 hourly; rinse and expel

NOTE: Avoid mouthwashes containing alcohol and phenol as they may cause more pain and further damage.

Table 8.4: Miracle Paint from Uganda

(this treats the underlying cause therefore reducing pain and discomfort)

Agent	Dose and Directions
1 capsule aciclovir (200 mg) and 5 mL nystatin (500 000 units) and 2 x 200 mg metronidazole tablets crushed	Mix together and use as a mouthwash or paint on oral ulcers twice a day; can also be used on genital ulcers.

Dry Mouth (Xerostomia)

Assessment

Numerous HIV-related conditions contribute to a sore, dry mouth (xerostomia), including candidiasis, aphthous ulcers (stomatitis), herpes simplex, and HIV infection itself, but a dry mouth is often simply caused by mouth breathing. Other causes include drugs such as antiretrovirals (e.g., indinavir), antihistamines, anticonvulsants, antidepressants, and anticholinergic drugs, which reduce salivary flow. Dehydration, reduced mastication, anxiety, and depression all reduce salivary flow. Oxygen therapy aggravates a dry mouth.

Management

Treating Reversible Causes

Treat infections such as candidiasis and herpes simplex (see sections below).

Review drug regimen. If a drug may be the cause, reduce dosage or change the drug if possible.

Non-pharmacologic symptom management

There is no evidence that rehydration results in any relief of xerostomia and simple palliative measures are usually more than adequate. In addition to the measures in Table 8.1, advise the patient or caregiver to:

- Create 'homemade' saliva. Methylcellulose + lemon essence + water is a possibility, but methylcellulose is often unavailable. Artificial saliva products are costly.
- Apply lubricating jelly to the tongue and oral cavity to keep the mouth moist and lubricated in patients with advanced disease.
- Give frequent sips of cold water or ice cubes to suck. If the patient is too ill for this, spray water in the mouth with a spray bottle or use a sponge stick.
- Offer a mouthwash 2-hourly.
- Feed soft, liquid foods that are easy to chew and swallow. Before patient eats, lubricate the inside of the mouth with a little butter, margarine, or salad oil.
- Humidify the room if the air is very dry.
- Give vitamin C tablets, sugar-free lemon-flavoured sweets, or sour sweets to suck.
- Give sugar-free gum to chew.
- Give fresh pineapple chunks to chew or suck (avoid if open sores in mouth).

Caries

Assessment

In people with HIV disease, rampant tooth decay frequently leads to pulpal infection (inside the root of the tooth) followed rapidly by abscess formation, which is important to either prevent or treat promptly. Therefore it is important for HCWs to examine the oral cavity during each routine examination.

A dry mouth with decreased salivary flow can result in multiple carious lesions (see Photo 8.1).



Photo 8.1: Cervical Caries,
Photo courtesy David I. Rosenstein

Management

Dental caries must be treated by a dentist, though HCWs can take initial steps. The first step, and clearly most important, is to determine if cavities that have extended into the pulp chamber of the tooth are causing an infection. This is recognisable by swelling. Treat infections immediately with antibiotics, preferably penicillin, but including metronidazole, as tooth abscesses are frequently due to anaerobic infections. Refer the patient to a dentist as soon as possible. The treatment for an abscess is the same for both HIV-positive and HIV-negative patients.

If a patient has no obvious infections, but decay is present, palliative care consists of fluoride mouth rinses with referral to a dentist as soon as possible. Management of a dry mouth (xerostomia) is important.

Oral Candidiasis

Assessment

Oral candidiasis is a relatively frequent problem for people with HIV. Pseudomembranous candidiasis, the most common form, appears as small, creamy white or yellow patches anywhere in the mouth (see Photo 8.2). The patches are loosely adherent and can be easily wiped off. There may be an erythematous area with or without bleeding under the patch. It most frequently affects the palatal, buccal, and labial mucosa and the dorsum of the tongue. The patient usually notices a change in taste, and food becomes undesirable. There may also be pain or a burning sensation associated with the lesion making eating more difficult.



Photo 8.2: Pseudomembranous Candidiasis,
Photo courtesy Sudeshni Naidoo

There are several other less common forms of candidiasis. Erythematous candidiasis often appears as a red lesion on the palate, dorsum of the tongue, and buccal mucosa. The lesions appear as multiple, flat, diffuse or discrete, red non-removable plaques. Median rhomboid glossitis, a variant of the erythematous form, appears as a smooth, red 'bald patch' (depapilated) area on the middle of the tongue. A matching lesion on the palate may be present (see Photo 8.3).



Photo 8.3: Erythematous Candidiasis,
Photo courtesy Sudeshni Naidoo

Angular cheilitis appears as red fissures or linear ulcers radiating from the corners of the mouth, with varying degrees of inflammatory erythema, and is often associated with small white plaques. Concurrent intra-oral candidiasis is a common finding. These lesions are usually painful and heal slowly due to repeated opening of the mouth (see Photo 8.4).

Hyperplastic candidiasis is the least common variant of candidiasis seen in HIV infection. Diffuse, white, adherent lesions are seen on the buccal mucosa. This form needs to be distinguished from oral hairy leukoplakia. High carbohydrate diets, smoking, and the wearing of dentures overnight may contribute to this lesion (see Photo 8.5).

Different manifestations of candidiasis may occur simultaneously and all forms should be treated promptly, especially if there is oesophageal involvement. For patients with advanced disease, particularly with wasting, untreated candidiasis can create serious and potentially life-threatening problems.



Photo 8.4: Angular Cheilitis,
Photo courtesy Sudeshni Naidoo



Photo 8.5: Hyperplastic Candidiasis,
Photo courtesy Sudeshni Naidoo

Management

Treating Reversible Causes

Topical treatment: Nystatin suspension 100,000 IU/mL: rinse and swallow 2.5 mL 5 times daily or 4 hourly (note: 5 mL may be required in immunosuppressed patients).

If this fails:

Suck clotrimazole pessaries 500 mg once daily for 5 days. This reaches the most resistant candidiasis as it effervesces in the mouth and gets to the parts the others cannot reach. Refer to it as a lozenge, not a pessary, to the patient, who might have reservations about sucking a pessary.

Or, if available,

2% miconazole gel applied 2–3 times daily x 10 days, and suck amphotericin B lozenges 10 mg 6 hourly for 10 days.

Note: Remove dentures when using topical medication for the mouth.

Systemic treatment: In patients not responding to topical therapy within one to two weeks, give an oral azole medication. These are very effective, and are the treatment of choice for oesophageal candidiasis; however, they are expensive and may not be available in resource-limited settings.

Fluconazole 50–100 mg once daily for 7 days

Or, if available,

Ketoconazole 200–400 mg once daily for 7 days

Itraconazole 200 mg once daily for 7 days

For angular cheilitis:

Topical nystatin cream or

Miconazole gel

Pharmacologic Symptom Management

Simple measures are often effective and include:

Antimicrobial mouthwashes (see Table 8.1)

Mouthwashes alone are only effective in the management of candidiasis if used regularly and frequently.

Gentian violet treatment (0.5%) painted in the mouth three times daily

Oral Hairy Leukoplakia

Assessment

The occurrence of hairy leukoplakia is associated with immunosuppression and a reduced CD4 count. The lesion appears as white, vertical corrugations almost always on the lateral border of the tongue, giving rise to a very characteristic striated appearance (see Photo 8.6). The condition can resemble pseudomembranous oral candidiasis; while oral candidiasis can be wiped off, hairy leukoplakia cannot. Lesions occur unilaterally or bilaterally.

Advise patients that this condition generally causes no discomfort, change in taste perception, or other problems. It can disappear, particularly with antiretroviral therapy.



Photo 8.6: Oral Hairy Leukoplakia,
Photo courtesy Sudeshni Naidoo

Management

Treating Reversible Causes

Because the presence of the lesion indicates immunosuppression, start the patient on cotrimoxazole prophylaxis to prevent other opportunistic infections that can be life-threatening.

The lesion itself is benign and usually is not treated. Treatment may be considered for cosmetic reasons or if the lesions become large and bothersome to the patient.

Specific treatment is aciclovir 800 mg 3–5 times daily for 10 days, or, *if available*, antiretroviral medication.

Recurrent Aphthous Ulceration

Assessment

Although aphthous ulcers are common for all patients, the duration and seriousness of the ulcers may be greater in people with HIV disease: aphthous ulcers *minor* more frequently become aphthous ulcers *major* (more than one centimeter in diameter) (see Photos 8.7 and 8.8).

Recurrent aphthous lesions are generally shallow, cratered lesions with a raised erythematous border and a grey, central pseudomembrane. The lesion is well-circumscribed with a white/grey covering surrounded by a red halo. Aphthous ulcers can occur anywhere in the mouth, but are usually limited to the mucosa of the soft palate, buccal mucosa, tongue, and tonsillar area. In patients with HIV infection the lesions can also occur on keratinized tissue.

Aphthous ulcers must be differentiated from recurrent herpes. Generally patients have had a history of one or the other and usually do not suffer from both, so a reliable history can determine which condition it is. Aphthous ulcers are deeper than herpetic ulcers and have a more well-defined edge. Herpetic ulcers are preceded by vesicles. Viral cultures, if available, for herpes simplex can also be helpful.

Patients with HIV require care for any lesion, irrespective of the size, to prevent it from expanding and creating potentially serious problems. The lesions cause pain, interfere with speech and swallowing and can become quite large, particularly in patients with HIV disease. Moreover, there can be secondary infection of the lesion, which should be treated immediately. Severe ulceration can extend to the oropharynx and oesophagus and result in inadequate oral intake and rapid weight loss.

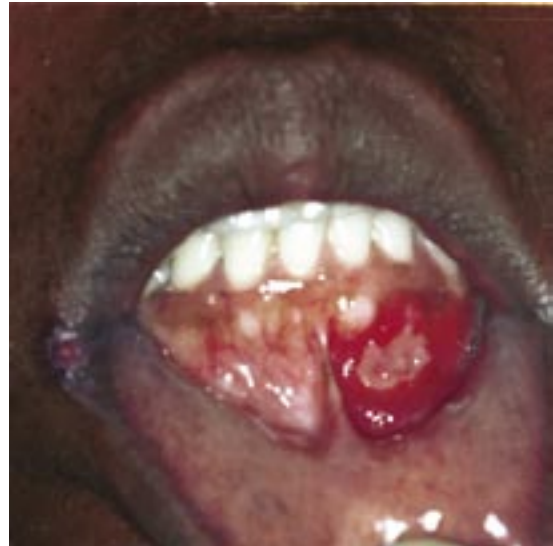


Photo 8.7: Aphthous Ulceration,
Photo courtesy Sudeshni Naidoo



Photo 8.8: Giant Aphthous Ulcer,
Photo courtesy Sudeshni Naidoo

Management

Pharmacologic Symptom Management

Early diagnosis and management are important to control pain and avoid interference with nutrition and hydration. Early treatment is the key and palliative care should be implemented immediately. Steps in treatment:

Pain control: See section on palliative management of oral pain. Oral morphine solution may be required.

Topical management:

- Apply topical steroids (see Table 8.3). It is important to exclude CMV and herpes ulceration before using steroids, as steroids exacerbate these ulcers.
- Apply 'Miracle paint' (see Table 8.4).

If available,

- Use antimicrobial mouthwashes (see Table 8.1). These should not be used at the same time as topical steroids or antifungals.

For large and persistent ulcers: (See Table 8.3)

- Tetracycline, 250 mg, dissolved in 15 mL water, used as a mouthwash three times daily has shown anecdotally to be very effective (probably because of treatment of superimposed infection)

If available,

- Thalidomide: 50 – 100 mg nocté (note precautions re teratogenicity)
- Beclomethasone spray
- Saline or benzydamine mouthwash
- Prednisolone, used in accordance with Table 8.3

Recurrent Herpes Simplex

Assessment

Herpes simplex lesions can be more painful, larger, and more prone to secondary infections in patients with HIV infection who are immunocompromised (see Photo 8.9). The lesions can accelerate the wasting syndrome by causing pain and decreasing the ability to eat comfortably. Although in immunocompetent people the lesions normally resolve in two weeks without treatment, in patients with HIV they may persist for several weeks and extend to the oesophagus.

Herpes simplex lesions start with a prodromal feeling of malaise, fever, and general debilitation, although this can be masked in patients who are already debilitated. There may be an itching or tingling sensation at the site. Then vesicles form, usually within 24 hours, with rupture shortly thereafter, forming painful irregular ulcers. Lesions occur on the gums, hard palate, vermilion border of the lips, and adjacent facial skin. Ulceration can progress rapidly in the immunodeficient patient, causing extensive mucocutaneous involvement (see Photo 8.10.) If ulcers are resistant to treatment, patients should be investigated for malignancy or CMV.



Photo 8.9: Herpes Stomatitis,
Photo courtesy Sudeshni Naidoo



Photo 8.10: Mucocutaneous Herpes,
Photo courtesy Sudeshni Naidoo

Management

Treating Reversible Causes

Apply topical antiviral medication if the condition is at an early stage prior to the rupture of the vesicles (see Table 8.3). Topical medications do not usually work as well as systemic medications but may be effective if applied early.

Give systemic treatment, especially if the vesicles rupture or are well established, using either:

aciclovir 200 mg tablet 5 times/day for 5 days (approximately 4 hourly, during waking hours)

Or, if available,

famciclovir 250 mg 3 times/day for 5 days

Non-Pharmacologic Symptom Management

Advise patients to avoid acidic food and drink.

Pharmacologic Symptom Management

Apply topical analgesia, such as 'Miracle Paint' (see Table 8.4).

If necessary, give systemic analgesia according to the WHO Three-step Analgesic Pain Ladder.

Linear Gingival Erythema

Assessment

Linear gingival erythema, an atypical gingivitis, appears as a 2–3 mm distinct fiery red band at the marginal gingiva around teeth (see Photo 8.11). Such erythema is not proportional to the plaque accumulation and seems to affect only the soft tissue, without any ulcerations, increased pocket depths, or any attachment loss. Patients are usually asymptomatic. There is evidence of an association between linear gingival erythema and candidiasis.



Photo 8.11: Linear Gingival Erythema,
Photo courtesy Sudeshni Naidoo

Management

Pharmacologic Symptom Management

Administer antimicrobial mouthwashes (see Table 8.1).

Apply topical antifungal therapy.

Necrotising Ulcerative Gingivitis

Assessment

This localised or generalised condition appears as destruction and necrosis of one or more interdental papillae with bleeding, ulceration, and sloughing (see Photo 8.12). Spontaneous bleeding and halitosis may occur. A whitish pseudomembrane outlines the affected area. Tissue destruction is limited to the gingival tissue and does not involve alveolar bone.



Photo 8.12: Necrotising Ulcerative Gingivitis,
Photo courtesy Sudeshni Naidoo

Management

Non-Pharmacologic Symptom Management

If available, refer patient to a dentist immediately (this is an urgent, high-priority referral).

Pharmacologic Symptom Management

Administer antimicrobial mouthwashes (see Table 8.1).

Give systemic antibiotics as a useful adjunct to treatment:

metronidazole 400 mg 8 hourly for 5 days
(use with caution in patients on lopinavir or ritonavir)

Or, if available,

co-amoxiclav 375 mg 8 hourly for 5 days

Give topical and systemic analgesia (see section on palliative management of oral pain).

Necrotising Ulcerative Periodontitis

Assessment

Periodontal disease is the chronic inflammatory process that affects the tissues and bone that support the teeth. Necrotising ulcerative periodontitis is characterised by localised to generalised aggressive necrotic destruction of the periodontium. There is rapid bone loss with exposure of bone, loss of attachment, and loosening of dead bone (see Photo 8.13).

The affected gingiva is erythematous and oedematous. The condition can result in premature loss of teeth and causes severe, deep-seated bone pain, spontaneous gingival bleeding, halitosis, and tooth mobility.



Photo 8.13: Necrotising Ulcerative Periodontitis,
Photo courtesy David I Rosenstein

Management

Non-Pharmacologic Symptom Management

Brush teeth with a soft toothbrush and, if available, chlorhexidine solution to speed up healing.

Use saline mouthwashes after every meal.

If available, refer to a dentist or an oral health care worker for intensive curettage and debridement of all necrotic soft and hard tissues, subgingival irrigation, plaque removal, and splinting or extraction of mobile teeth (this is an urgent, high-priority referral).

Monitor regularly every two to three weeks. If oral health care is available, refer for follow-up scaling and debridement. Recurrences are common. Encourage patients to brush and floss meticulously to maintain a maximum level of oral health. Continue mouthwashes until symptoms are gone and all diseased tissues are removed. Frequent dental examinations are essential.

Pharmacologic Symptom Management

Administer antimicrobial mouthwashes (see Table 8.1).

Give metronidazole mouthwashes, which can be swallowed after rinsing through teeth.

Give systemic antibiotics:

metronidazole 400 mg 8 hourly for 5 days

or,

co-amoxiclav 375 ml 8 hourly for 5 days.

Give pain medication according to the WHO 3-Step Analgesic Pain Ladder (see section on palliative management of oral pain).

Apply topical analgesia (see section on palliative management of oral pain).

Kaposi's Sarcoma (KS)

Assessment

Kaposi's sarcoma (KS), the most common opportunistic neoplasm in patients with HIV, occurs when immune suppression is severe and patients have end-stage HIV disease. It often first appears on the roof of the mouth as a flat or raised, asymptomatic, blue or purplish lesion that does not blanch with pressure (see Photo 8.14).

Lesions may be single or multiple macules or nodules. Intra-oral lesions are initially asymptomatic but they often enlarge rapidly with ulceration, bleeding, and superinfection causing pain, discomfort, and dysphagia.

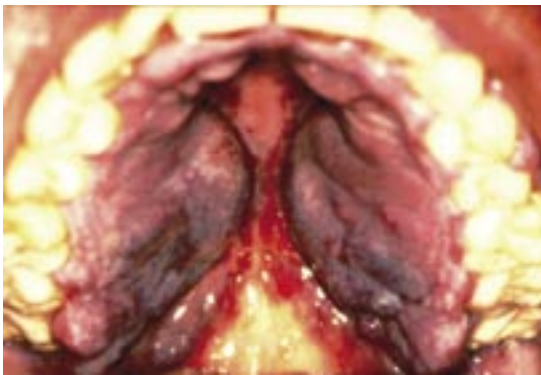


Photo 8.14: Kaposi's sarcoma,
Photo courtesy Sudeshni Naidoo

Management

Treating Reversible Causes

If available and suitable to the clinical stage of the disease as assessed by CD4 count, give ART, which can result in regression of KS.

Non-Pharmacologic Symptom Management

Provide good oral hygiene and plaque control to prevent secondary infection.

Pharmacologic Symptom Management

Apply benzydamine hydrochloride to relieve pain associated with mucositis.

If available, consider the following:

If localised oral lesions interfere with function, palliative treatment can be given:

- Excise lesions with laser or surgically, or
- Inject with intralesional vinblastine (0.2 mg/mL).

Treat disseminated disease with systemic administration of multiple or single agents such as vincristine, bleomycin, interferon, and doxorubicin.

Radiotherapy over a 10–12 day period is helpful but has the potential adverse effect of mucositis and xerostomia.

Non-Hodgkin's Lymphoma

Assessment

Non-Hodgkin's lymphoma occurs when immune suppression is severe and patients have end-stage HIV disease. In the oral cavity it is most often an exophytic soft, tumour-like mass that can enlarge rapidly (see Photo 8.15). These tumours may be red and inflamed, progress rapidly, and cause pain and interference with chewing and speech. Biopsy is required for diagnosis.



Photo 8.15: Non-Hodgkin's Lymphoma,
Photo courtesy David I. Rosenstein

Management

Pharmacologic Symptom Management

Treatment is almost always palliative and not curative.

If available, consider

administering radiation and/or chemotherapy, or surgically excising large exophytic or pedunculated lesions.

Suggested Resources

Arendorf T, Sauer G, Bredekamp B, Cloete C. *Guidelines for the Diagnosis and Management of Oral Manifestations of HIV Infection and AIDS*. WHO Collaborating Centre for Oral Health, Faculty of Dentistry, University of the Western Cape, South Africa.

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