

# Management of oral and maxillofacial infection

*H Witherow, BD Swinson, M Amin, N Kalavrezos, L Newman*

**Maxillofacial infections are common but can potentially be life threatening. Accurate diagnosis is essential to prevent mismanagement with potential severe consequences. This article discusses the aetiology, differential diagnosis, host response, spread of infection and treatment.**

Infections may be classified by timeframe (acute or chronic), organism (viral, bacterial, fungal or protozoal) or structures involved, which include soft tissue, salivary gland, bone, teeth or lymphatic tissues.

Severity of infection depends on the virulence of the micro-organism and host defence mechanisms. Breaches of local defences include disruption of anatomical barriers by trauma, or change in the host's normal flora by antibiotics allowing proliferation of fungi. Immunocompromise will alter the balance, as will metabolic disease.

A detailed history is essential to elicit the cause and any possible systemic reason for infection. Examination must be systematic, including examination of the teeth, supporting mucosal structures and cervical nodes draining the area. Further systemic examination may be indicated from the history. Investigations should identify the cause, determine the systemic effect of infection and exclude any problems with host immunity.

## VIRAL INFECTIONS

Numerous viruses may cause infections in and around the mouth. The commonest include herpes labialis, herpes simplex, herpes zoster, chicken pox, paramyxovirus (mumps or measles), herpangina coxsackie, rubella, papillomavirus and human immunodeficiency virus (HIV).

### Herpes virus

This is one of the most common viral infections involving the mouth. Primary infection occurs when the host has no antibodies to the virus. Infection at an early age usually produces sub-clinical or only minor symptoms, whereas primary infection in the adult may be severe. Serious complications may occasionally occur in the immunocompromised. Cerebral, ocular and overwhelming skin infection may occasionally have fatal results.

Features of acute primary herpetic gingivostomatitis may include fever, irritability, headache, pain on swallowing and regional lymphadenopathy (Amir et al, 1999). Within a few days tiny vesicles develop in the mouth, which rupture to form painful ulcers, usually healing within 7–10 days.

Diagnosis by smears from the vesicle using polymerase chain reaction usually detects the virus (Madhavan et al, 1999). However, in most patients diagnosis can often be made from the history and examination. Treatment is symptomatic, based on analgesia, hydration and prevention of secondary bacterial infection.

**Secondary herpetic infections:** The virus remains dormant in the dorsal root ganglia of the trigeminal nerve and may be activated by triggers including upper respiratory tract infections and sunlight. Use of topical antiviral agents in the prodromal phase may reduce severity of infection. In the immunocompromised overwhelming infection may occur, and systemic antivirals may be needed.

### Human immunodeficiency virus infection

Oral lesions are a prominent feature of acquired immunodeficiency syndrome (AIDS) and HIV infection, and are often the first indicator of disease progression (Lim et al, 2001). The common manifestations of HIV are mainly infective, particularly fungal, viral and mycobacterial. Neoplastic forms (Kaposi's sarcoma and lymphomas may be virally induced) and autoimmune disorders (Butt et al, 2001) may be the first signs of HIV infection (*Table 1*). Occasionally more unusual pathology can occur, e.g. parotid cysts (*Figure 1*) or molluscum contagiosum (*Figure 2*).

## FUNGAL INFECTIONS

### Candida

Candidiasis is caused by infection with a yeast-like fungus, *Candida albicans*. This is a common-

Ms H Witherow,  
Mr BD Swinson and  
Mr M Amin are  
Specialist Registrars in  
Maxillofacial Surgery,  
Mr N Kalavrezos and  
Mr L Newman are  
Consultants in  
Maxillofacial Surgery,  
Department of  
Maxillofacial Surgery,  
University College  
Hospital,  
London WC1E 6AU

Correspondence to:  
Ms H Witherow

sal organism in about 40% of people. It causes infections when local or systemic factors favour proliferation of the organism or when normal immunity, either local or systemic, is reduced.

Predisposing factors include extremes of age, drugs (such as broad-spectrum antibiotics, systemic or inhaled steroids) or immunosuppression (chemotherapy, HIV, leukaemia, diabetes and malnutrition). Candidiasis may also occur where the host's local defence barriers are damaged, i.e. local trauma from ill-fitting dentures or radiation mucositis. Candidiasis may be the first sign of an underlying systemic disease.

**Clinical features: Acute pseudomembranous candidiasis (thrush):** The infection appears in the mouth as superficial, curdy white patches which are easily wiped off leaving a raw red area. This often affects neonates or adults taking broad-spectrum antibiotics. Infection may be self-limiting or treatment with topical antifungal agents, e.g. nystatin or amphotericin B, may be necessary. In resistant cases systemic agents may be needed.

**Acute atrophic candidiasis:** This usually affects the tongue, which becomes smooth and painful. It is usually seen after long-term steroid use or use of broad-spectrum antibiotics. Diagnosis is made from the clinical picture and from microbiological swabs of the area. Treatment is as above.

**Chronic atrophic candidiasis:** This is associated with upper dentures, either as a result of prolonged wear or trauma from ill-fitting dentures. The clinical picture is one of a bright red mucosa under the denture. Resolution of the infection often requires simple measures, such as removing dentures at night or remaking ill-fitting dentures.

**Chronic hyperplastic candidiasis:** Long-term candida infection of the oral tissues, often in smokers, can produce a leucoplakia which is

considered pre-malignant. Examination for induration or ulceration is important. Baseline biopsy and regular review is essential. Systemic antifungal therapy may be useful.

**Geographic tongue:** This is so called because of the 'map-like' depapillation and erythema of the tongue and was previously thought to be idiopathic. However, biopsies of these lesions usually reveal candidal hyphae. Symptoms of pain and 'burning' often respond to antifungal agents.

## BACTERIAL INFECTIONS

### Tuberculosis

This is a chronic granulomatous disease caused by *Mycobacterium tuberculosis*. The incidence is rising in the UK because of the rise of HIV infection and increased travel and migration (Cleary and Batsakis, 1995). Oral tuberculosis is usually secondary to chest involvement. The tongue is usually involved. The lesion presents as a persistent ulcer usually with an undermined edge. Cervical lymphadenopathy may be present and an abscess may form (Figure 3). Investigations include chest X-ray, sputum sample, full blood count and erythrocyte sedimentation rate, Heaf test and biopsy for identification of acid-fast bacilli, culture and histology (which shows caseating granulomas).

Tuberculosis in children is increasing and is more often caused by atypical organisms such as *M. avium intracellulare*.

### Actinomycosis

Actinomycosis is a chronic granulomatous infection caused by *Actinomyces israelii*, a Gram-positive filamentous organism, which is a commensal.

**TABLE 1.**  
**Oral and maxillofacial lesions frequently seen in HIV/AIDS**

Hairy leucoplakia
Candidal infection
Papilloma viral warts
Parotid cysts
Kaposi's sarcoma
HIV-associated periodontitis/gingivitis
Herpes zoster
Apthous-like ulceration
Lymphoma
Angular cheilitis

AIDS = acquired immune deficiency syndrome;  
HIV = human immunodeficiency virus



Figure 1. Computed tomogram scan showing parotid cysts.



Figure 2. Molluscum contagiosum.

Cervicofacial actinomycosis often presents as a relatively symptomless localized swelling of the subcutaneous tissue of the cheek or below the angle of the mandible (Miller and Haddad, 1998). The skin becomes purplish red and appears chronically inflamed. The area becomes very firm and indurated and eventually pus discharges from multiple sinuses (Figure 4).

Diagnosis can be difficult to establish as a result of previous repeated courses of antibiotics, but is made by careful collections of the pus and looking for 'sulphur granules' (actinomycosis colonies). Treatment is with high-dose penicillin or ampicillin for several months.

## ODONTOGENIC INFECTIONS

### Aetiology

Infections of dental origin are very common and may present as pain, swelling, trismus, sinusitis, lymphadenopathy or facial sinuses. Microorganisms responsible for the infections are generally mixed anaerobic and aerobic with a predominance of *Streptococcus viridans*.

### Pericoronitis

This is relatively common. It is caused by infection of the soft tissue follicle, usually of an erupting tooth, often the third molar. Direct communication has to occur between the mouth

and the follicle, which may be small and difficult to see, but X-rays will show the erupting tooth. Usually attacks of pericoronitis become less frequent as the tooth erupts. Infections can vary from slight swelling and soreness to severe trismus, systemic infections and airway compromise. Treatment for minor infections includes improved oral hygiene, with frequent warm salt water and chlorhexidine mouthwashes. Systemic antibiotics if required include amoxycillin, metronidazole and clindamycin. Indications for removal of the tooth are more than one episode of pericoronitis or one episode of severe infection requiring antibiotics.

### Periodontal abscess

Infection secondary to periodontal disease may present as a painful swelling usually involving gingival tissue surrounding the tooth. There is usually evidence of pocketing around the tooth, which is usually vital. X-rays show evidence of bone loss around the teeth. If infection is mild, treat with oral hygiene measures, deep scaling of the area and warm salt water or chlorhexidine mouthwashes. More severe infections may require drainage of the abscess, extraction and systemic antibiotics, e.g. metronidazole or amoxycillin.

### Periapical abscess

The pulp of a tooth may die for a number of reasons; decay and trauma are usually clinically obvious. Only 50% of patients presenting with odontogenic infections have a history of toothache. Clinical features usually include a history of pulpitis, a poorly located, often severe pain, aggravated by hot or cold. The tooth involved is usually tender to percussion.

### Presentation of odontogenic infection

Pus from inflammatory degeneration of the pulp or periodontal disease may track through the bone following the path of least resistance and perforate the cortical plate to present either intra- or extraorally. Once pus has entered the soft tissue its direction of spread is limited by muscles and fascial planes, which tend to direct the pus towards certain areas where it accumulates. The muscles which commonly contain an infection around the maxilla and mandible are mylohyoid, buccinator, masseter, medial pterygoid and the superior constrictors.

If the apices of the teeth are below the maxillary muscles and above the mandibular muscles the infection usually presents intraorally as a painful swelling. If the apices are above the maxillary or below the mandibular muscles infection may present extraorally. Infection may localize, forming an abscess, or may spread diffusely into the soft tis-



Figure 3. Neck abscess in tuberculosis.



Figure 4. Cervicofacial actinomycosis.

sue causing cellulitis. Usually pus becomes fluctuant and discharges via a sinus. Dentocutaneous sinuses present most often over the mandible (Cioffi et al, 1986) and maxilla (Figure 5), but may appear over the chest, neck, medial canthus or at distant sites (Cioffi et al, 1986; Cohen and Eliezri, 1990). Infections involving the muscles of mastication, masseter, temporalis or the pterygoids may cause severe trismus.

Treatment includes drainage of the collection via an extra- or intraoral route, support of the patient and removal of the dental cause.

### Complications of odontogenic infections

There are a number of different complications, some of which are outlined below.

**Ludwig's angina:** Spreading infections through the soft tissue may be particularly serious because of the close proximity to the airway. Spread of infection into the loose sublingual tissues may produce gross oedema and elevation of the tongue, compromising the airway (Barakate et al, 2001). The patient is unable to swallow his/her saliva and may present with drooling and dyspnoea. Treatment is maintenance of the airway, steroids, intravenous antibiotics and surgical drainage with removal of the source of infection.

**Trismus:** Involvement of the muscles of mastication, the masseters, temporalis or pterygoid muscles causes spread of infection into the submasseteric, infratemporal fossa or parapharyngeal space which may produce severe trismus. This makes intraoral examination difficult and complicates endotracheal intubation. Investigations include X-rays such as an orthopantomogram, haematological investigations including a full blood count, electrolytes and random blood glucose. Treatment includes control of the infection, support of the patient and removal of the cause. If required intubation under anaesthesia should be performed by an experienced anaesthetist.

**Orbital cellulitis:** Infection of the maxillary teeth may track to the orbit, either directly (Figure 6) or

via the maxillary antrum. The orbit is a potential danger area as infections may affect the orbital contents but may also spread via intracerebral venous connections (Figure 7), resulting in potential fatal complications such as cerebral abscesses (Figure 8), meningitis or cavernous sinus thrombosis. Orbital infections may cause decreased visual acuity or blindness by directly damaging the optic nerve (Tovilla-Canales et al, 2001).



Figure 6. Orbital cellulitis.

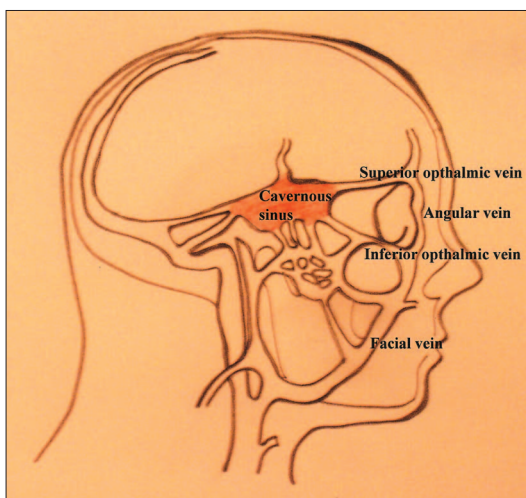


Figure 7. Diagram showing connections from the mouth, sinuses and brain.

Figure 5. An odontogenic sinus.

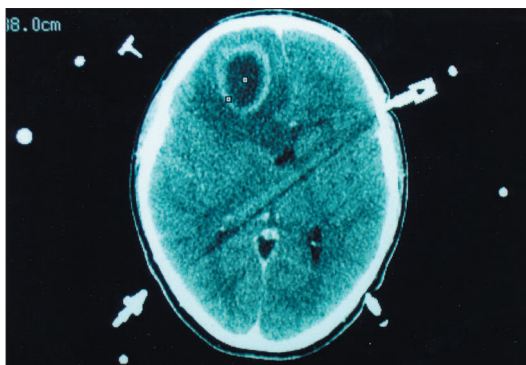


Figure 8. Computed tomography scan showing cerebral abscess secondary to sinusitis from a periapical abscess of an upper second molar tooth.

Cavernous sinus thrombosis is a rare complication of orbital cellulitis, which has a high morbidity (Ebright et al, 2001). The signs include periorbital oedema, proptosis, ophthalmoplegia, a sensory deficit involving the ophthalmic nerve, a dilated pupil and absent corneal reflex. Management involves urgent referral to a neurosurgical unit, support of the patient, high-dose systemic antibiotics and corticosteroids.

**Mediastinitis:** This is a rare complication of an abscess of a mandibular tooth, usually a molar, that has root apices below the mylohyoid muscle (McCurdy et al, 1977). The deep cervical fascia is attached superiorly to the mandible but has no attachment inferiorly, directing pus directly to the mediastinum. Mediastinitis has a high morbidity. The patient is usually systemically unwell and should be managed in an intensive care unit with direct input from a cardiothoracic unit.

## INFECTION OF THE JAW AND BONES

### Local osteitis

Local osteitis or 'dry socket' usually occurs following a tooth extraction. Breakdown of the clot exposes the bone. The socket is very painful and the patient may complain of a bad taste. There are no signs of systemic infection. Risk factors for developing a dry socket are extraction of lower molar teeth, difficult extractions, older patients, poor oral hygiene and smoking. The condition usually responds well to local measures such as irrigation and topical dressings.

### Osteomyelitis

Infection of the medullary cavity of the jaws is relatively infrequent in the developed world since the development of antibiotics. It usually occurs as a result of an underlying host defence problem. The organisms involved include *Staphylococcus aureus*, anaerobic bacteria such as *Bacteroides*, and anaerobic streptococci.

Clinical signs and symptoms include severe local pain, mild fever, and occasionally paraesthesia of the lower lip if the mandible is involved.



**Figure 9.**  
*Osteoradionecrosis of the mandible following dental neglect and radiotherapy.*

Later swelling, sinus formation, tooth mobility, trismus and pathological fracture may occur. Radiographic evidence in the early stages shows little change. Later gradual resorption and attempt at repair gives rise to a moth-eaten appearance. Bony sequestra may be seen and sub-periosteal bone reaction is seen as the body attempts to lay down new bone. Systemic causes of immunocompromise should be investigated, and culture of the organism and systemic antibiotics should start as soon as possible. Antibiotics should be continued for 2 weeks after clinical resolution of infection.

### Osteoradionecrosis

This is normally seen following radiotherapy for head and neck cancers. Improved techniques have significantly reduced this complication but it may present with pain, exposed dead bone in an irradiated mouth, extra- or intraoral sinuses or with a pathological fracture. Treatment is usually long-term antimicrobials, with hyperbaric oxygen therapy playing a role (*Figure 9*).

## INFECTION OF THE SALIVARY GLANDS

### Mumps

This is the most frequent viral infection to affect the parotid, caused by a paramyxovirus. Symptoms include pyrexia, sore throat and bilateral parotid swelling. Unilateral swelling is occasionally seen. Rare complications, especially in the immunocompromised individual, include meningoencephalitis and orchitis. The infection usually lasts 10 days. A rising titre of immunoglobulin M antibodies to the mumps virus is diagnostic. The white cell count is usually raised with an increase in lymphocytes. Other viruses such as parainfluenza, echo, cytomegalovirus and coxsackie may cause parotitis. Treatment is based on symptomatic relief, with analgesia and hydration.

### Acute suppurative sialadenitis

This is most often seen in the parotid gland and is usually unilateral. When it occurs in the submandibular gland it is usually associated with obstruction secondary to a stone (*Figure 10*).

It may occur without obstruction in debilitated dehydrated patients, sometimes postoperatively. Organisms ascend from the mouth into the gland and are usually mixed flora, but may include alpha-haemolytic and anaerobic streptococci, *Staph. aureus*, *Haemophilus* and *Bacteroides*. Signs and symptoms include a high temperature, pain and swelling of the affected gland. There is usually a neutrophil leucocytosis. Investigations should include ultrasound to identify any collections, which may need draining. Culture and sensitivity of the pus is desired, followed by

appropriate intravenous antibiotics. Needle aspiration or formal drainage of pus may be necessary. Adequate rehydration and analgesia is essential.

### Chronic obstructive sialadenitis

Obstruction of salivary flow from a gland may be caused by a number of pathologies including stones, strictures and tumours. Salivary flow may be diminished in patients who have had radiotherapy, those with Sjögren's syndrome and those taking diuretics. With salivary stasis organisms ascend from the mouth and may cause infection. Patients often complain of pain and swelling when eating because of the increase in salivary flow. The parotid gland should be examined both externally and intraorally. The deep lobe of this gland can only be palpated intraorally. The submandibular gland should be palpated bimanually. Investigations include plain radiographs to identify radio-opaque stones. Ultrasound, magnetic resonance imaging and computed tomography have taken over from the sialogram. This may still be useful, however, for identifying filling defects and structural damage. Treatment depends on the cause. Stones may be surgically removed if access permits. Endoscopic retrieval has been used and lithotripsy is playing an increasing role. The gland may need to be removed if parenchymal damage is severe.

### INFLAMMATORY CAUSES OF NECK LUMPS

A wide range of diseases may present with lesions or swellings in the neck. The most common of these are swellings and infections of the lymph nodes. Most conditions above will produce a reactive lymphadenopathy in the cervical lymph nodes, but other infective conditions should be borne in mind in the differential diagnosis.

Viral causes include herpangina, as well as herpes simplex and zoster. Tuberculosis is seen with cervical lymphadenopathy as a presenting sign. Other bacterial infections include brucellosis, cat-scratch fever and syphilis. Toxoplasmosis may present as cervical lymphadenopathy, especially in immunocompromised patients.

Systemic conditions, e.g. connective tissue diseases, sarcoidosis or Crohn's disease, should also be borne in mind.

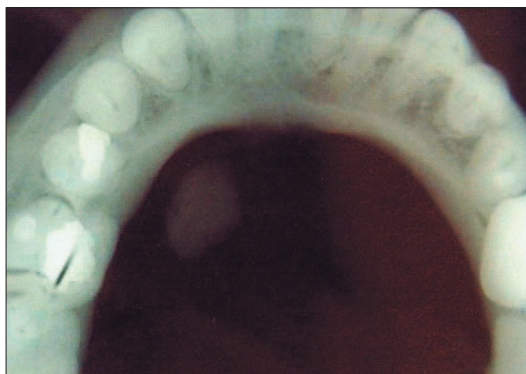
### CONCLUSIONS

Maxillofacial infections are common and may present to colleagues in accident and emergency, general surgery, dermatology or ear, nose and throat surgery. Owing to the proximity of the airway and vital structures, rapid diagnosis and prompt initiation of treatment is required to

avoid serious sequelae. A careful history, thorough examination and appropriate investigations are essential to establish the diagnosis and urgent referral to a specialist team is indicated if any doubt remains. **HM**

*Conflict of interest: none.*

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**Figure 10.** Radio-opaque stone in submandibular duct.

### KEY POINTS

- Principles of management should include control of infection, support of the patient and removal of the cause.
- In 50% of patients with infections of odontogenic origin there will be no history of dental pain.
- Maxillofacial infections may be potentially life threatening – beware of periorbital infections, trismus and swelling compromising the airway.
- Culture and sensitivity of any pus should be started before prescribing broad-spectrum antibiotics. Serology for rising titres of viruses should be considered.
- Oral infections may be the first sign of a systemic infection, i.e. tuberculosis, or of problems with the host's immunity, i.e. diabetes, malnutrition or immunocompromise.