Review: A review of the epidemiology and an update of infection control recommendations

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Abstract
Tuberculosis is the world’s leading cause of death from a single infective agent. The World Health Organisation has declared the disease a “global emergency”. TB is a major public health problem in South Africa. In 2007, the WHO ranked South Africa fifth among the world’s 22 high-burden TB countries. The TB epidemic in South Africa is likely to get worse over the next few years due to the high prevalence of HIV/AIDS. Extra-pulmonary presentations make up a major proportion of new cases, especially since the acquired immunodeficiency syndrome epidemic. Therefore, it is important that oral healthcare workers are aware of tuberculosis in the head and neck region and its varied manifestations to enable early diagnosis and commencement of appropriate treatment.

M. tuberculosis is hazardous to oral healthcare workers because of its airborne route of transmission, lack of effective vaccination, the long and tedious treatment regimen, presence of resistant strains and the long-term sequelae of the infection. TB infection control policies and protocols for implementing these control measures should be included in a dental setting’s overall infection control program and should be reviewed annually.

Key words: Tuberculosis, HIV, oral healthcare workers, infection control

Introduction
Tuberculosis (TB) is a highly infectious, debilitating disease that typically involves the pulmonary system, but can affect any organ or tissue, including the mouth.1 While TB notification rates continue to decrease in many parts of the world, rates have increased more than three-fold in many countries in sub-Saharan Africa since 1990, fuelling a 1% increase in global TB incidence.2 In 1993, it was the world’s leading cause of death from a single infectious agent. The World Health Organisation (WHO) declared the disease a “global health emergency”.3

Globally TB remains one of the leading causes of death resulting from infectious disease.4 Mycobacterium tuberculosis (M.tuberculosis) is thought to infect an estimated 2 billion people (one-third of the world’s population).4 In 2007, approximately 9.27 million new cases of TB developed, and 1.78 million people died.4 In 2007 Africa made up 55% of the estimated number of cases and South Africa ranked fifth in terms of total number of cases (0.46 million).4 Of the 9.27 million incident TB cases in 2007, an estimated 1.37 million (15%) were human immunodeficiency virus (HIV)-positive and 79% of these HIV-positive cases were in the African Region and South Africa accounted for 31% of these cases. Thirteen of the 15 countries with the highest estimated TB incidence rates were in Africa, a phenomenon linked to high rates of HIV co-infection.4

In 2005 the African continent, with just 11% of the world’s population, accounted for 27% of the global burden of TB and 30% of TB related deaths. Over two million new TB cases and over 500 000 TB-related deaths are estimated to occur in the region annually.5 Factors that influenced the resurgence of the disease included the emergence of multidrug-resistant (MDR) organisms, social deprivation (injection drug use, homelessness, poverty), the increasing population of young adults that constituted the majority of the infected subjects, immigration from endemic areas, deteriorating healthcare infrastructures and the Acquired Immune Deficiency Syndrome (AIDS) pandemic.

About a third of the world’s population (about 2 billion people) carries the TB bacteria, but most never
develop the active disease. Around 10% of people infected with TB actually develop the disease in their lifetime, but this number is increasing due to the HIV that severely weakens the human immune system and makes people more vulnerable to infections.

The impact of HIV on the TB epidemic is potentially catastrophic: HIV increases the susceptibility of the HIV positive person to TB. The advent of HIV has resulted in 5 – 10% annual risk of developing TB as compared with 5 – 10% lifetime risk of TB infection in people without HIV. About 50% of TB patients in South Africa are infected with HIV. Nosocomial transmission of TB among HIV-infected individuals is a major hazard as was illustrated by the recent outbreak of extensive drug resistant (XDR) TB in Kwa-Zulu-Natal in 2006.

Tuberculosis infections are acquired by inhalation of the tubercle bacilli that are present in airborne particles. TB of the respiratory tract is the most infective form. Prior to the HIV epidemic, 85% of reported TB cases were limited to the lungs. This has now changed particularly in HIV infected individuals as extra-pulmonary TB tends to increase in frequency if immune function is compromised. With the decrease in the general incidence of head and neck involvement to a point where it was taken as a rare finding, clinicians were not “sensitized” to the head and neck manifestations as part of a differential diagnosis. This has often resulted in a delay in the diagnosis and therapy or the diagnosis being missed entirely. After a decline for several decades, the incidence of mycobacterial disease as a whole, and the extra-pulmonary type in particular, is on the rise in many regions of the world. TB often presents in the head and neck with the cervical lymph nodes being one of the commonest sites of extra-pulmonary TB. Other head and neck manifestations may also present in the oral cavity, nose, ears, larynx, thyroid and salivary glands, but these locations are rare.

*M. tuberculosis* is uniquely hazardous to oral healthcare workers because of its airborne route of transmission. The resurgence of TB as a public health problem has rekindled interest in the disease among oral healthcare workers. However, much research has focused on pulmonary and extra-pulmonary TB (excluding head and neck) and there is a paucity of literature on the head and neck region. In some instances, systemic symptoms of TB may be absent, and head and neck lesions may be the first manifestation of the disease. Therefore oral healthcare workers need to be aware of TB in the head and neck region and its varied manifestations.

**Tuberculosis in South Africa**

TB remains the most important communicable disease in the world and in South Africa it accounts for 80% of all notifiable diseases. The annual number of new cases averages 380/100 000 population – even in other hard hit parts of the world, the average is only about 200 per 100 000.

The TB epidemic in South Africa is one of the worst in the world, and in some impoverished parts of the country it has the fastest growing epidemic than anywhere else in the world. Nearly two thirds of the population in the country are infected with TB. The burden of TB in South Africans from all walks of life become ill with TB every year and about 10 000 people die of TB every year. Poorer communities are at greater risk of exposure to both acute and chronic TB infection. TB has been common in South Africa since colonisation and early urbanization. The notification rate has varied from around 50/100 000 in the 1920s, increasing to about 350/100 000 in 1965 followed by a decrease until 1988 when the notification rate was 172/100 000. In 2004 the national incidence rate was an alarming 718/100 000 – a major increase from 338 per 100 000 in 1998.

TB is a major public health problem in South Africa. In 2007, the WHO ranked South Africa fifth among the world’s 22 high-burden TB countries. The TB epidemic in South Africa is likely to be exacerbated over the next few years due to the high prevalence of HIV/AIDS. TB-HIV co-infection rates are high, with as many as 60% of adult TB patients being HIV-positive. MDR-TB, largely caused by non-adherence to drug regimens or inappropriate drug regimens, is further exacerbating the epidemic. National studies of MDR-TB conducted by the Medical Research Council of South Africa in 2002 found that 1.6% of new TB cases and 6.7% of re-treatment cases had MDR-TB.

The proportion of people with extra-pulmonary TB has also trebled, but appears to have stabilised at around 15%. Despite a global slowing down in new TB cases since 2003, South Africa recorded the world’s second highest rate of new cases (incidence rate) in 2006 after Swaziland. The WHO report in 2006 revealed that 218 people per 100 000 died of TB in South Africa. This was more than in any other country in the world. The problem of TB in South Africa is largely a result of historical neglect and poor management systems, compounded by the legacy of fragmented health services.

In South Africa, attention has been refocused on the factors associated with the observed reversal of previous declining disease trends, transmission modes of *M. tuberculosis*, occupational risk factors and airborne infection control precautions. Despite dramatic improvements in public health measures associated with *M. tuberculosis* infection and disease, such as living conditions, nutrition and antimicrobial chemotherapy, TB remains a major public health problem for much of the world’s
population. 20-21

HIV and TB Co-infection

The impact of HIV on the TB epidemic has been catastrophic. HIV increases the susceptibility of the HIV positive person to TB. TB is 500 times more common in HIV-infected than in the normal population. More than three quarters of affected patients develop extra-pulmonary disease. 22-25 Of the 36 million HIV infected persons in the world, one third are co-infected with \textit{M. tuberculosis} and 75% of these people reside in sub-Saharan Africa. 26 Latent infections present in HIV patients have a 7-10% annual risk of reactivation compared to a 5-10% lifetime risk in an HIV uninfected patient. They have a 10-20% chance of acquiring TB from an open contact compared to 5-10% in a non-HIV patient and a 30-40% chance of developing progressive primary disease as compared to 5-10% in a non-HIV individual. More than 60% of HIV infected patients can develop disseminated miliary or extra-pulmonary disease compared to less than 25% in non-HIV patients. The escalation in TB case rates in sub-Saharan Africa is largely attributable to the explosive HIV epidemic. The annual new case (8 million) and death (2 million) rates in sub-Saharan Africa are expected to continue to rise. 26

A weakened immune system allows for dissemination of the bacteria to areas other than the lungs, which explains the increased likelihood of extra-pulmonary TB among HIV positive individuals. 27

Experienced clinicians in central Africa have noticed a change in the pattern of the disease. Patients produce no sputum or have negative sputum smears, little change in chest radiography, or there may be diffuse pulmonary infiltrates without cavitation. Extra-pulmonary disease appears to be more common – especially in forms where they were previously uncommon. 28 The change in disease pattern has made diagnosis of TB more difficult. 24, 28 Extra-pulmonary TB can be difficult to diagnose and differentiation from neoplastic or other inflammatory conditions can be difficult, particularly in mucosal TB involving the larynx, hypopharynx and nasopharynx. 29

In view of the high frequency of non-cavitatory pulmonary disease and extrapulmonary forms of TB, sputum smear microscopy has a low sensitivity for diagnosis. Sensitivity is substantially increased by sputum culture, but this is slow and expensive and the necessary infrastructure is not available over much of Africa. 30

TB, which can occur at any time during the course of HIV, most often occurs early in the disease and probably accelerates the progression of HIV disease. 50 The WHO Directly Observed Treatment Short course (DOTS) strategy remains the central component of global TB control strategies. However, while successful in low HIV prevalence settings, this strategy alone has proven insufficient to contain the African TB epidemic in high HIV prevalence countries.

Head and Neck Manifestations of TB

Head and neck TB can present in many forms depending on the site of involvement, the stage of the disease and the immune status of the patient. Head and neck TB forms nearly 10% of all extra-pulmonary manifestations of the disease. 31 Therefore oral health professionals need to be aware of TB in the head and neck region and its varied manifestations. 22 The cervical lymph nodes are one of the commonest sites of extra-pulmonary TB. Other sites include the oral cavity, nose, ears, larynx, pharynx, thyroid, salivary glands, eye, cervical spine and mandible. 32

Cervical Lymph Nodes

The cervical lymph nodes are the most common site in the head and neck region to be affected by TB. 22, 33-34 The presentation could be an isolated, discreet, affected node or the more common collection of matted nodes. 34 The upper deep cervical nodes are commonly involved with matting, ulceration and abscess formation. 22 A fluctuant mass is present in 10% of patients and a draining sinus is present in 5% of patients. Skin overlying the lesion may appear erythemic and may be tender to palpation. The clinical course and treatment are different for tuberculous and non-tuberculous mycobacteria, therefore it is important to differentiate between masses caused by them. The posterior and supravacular lymph nodes are involved with tuberculous mycobacterial infections. Nontuberculous mycobacterial infections involve submandibular and submental cervical lymph node groups. These infections are generally seen in children between the ages of 1 and 5 and in immunocompromised patients. Constitutional symptoms are rare and chest x-rays are negative for signs of pulmonary TB. 34

The incidence of tonsillar, submandibular and submental lymph nodes affected by \textit{M. tuberculosis} could be as high as 10% of cases of pulmonary TB. The consistency of nodules varies with the stage of disease. A clinical classification by Hooper states that in Stage 1 the nodes are enlarged, firm, mobile, discrete and slightly tender showing non-specific reactive hyperplasia. In Stage 2 the nodes are larger, rubbery and fixed to surrounding tissues because of periadenitis with caseation. In Stage 3 there is central abscess formation, Stage 4 collar-stud abscess formation and Stage 5 sinus formation. 35 Treatment in the management of peripheral lymph node TB includes surgical incision with chemotherapy, chemotherapy first and then surgery or chemotherapy alone with anti-tubercular drugs for varying durations. 3, 36
Larynx
There are two theories that attempt to explain the infectious route of laryngeal TB. The bronchogenic theory states that the larynx is infected by direct spread of large numbers of bacilli from the endobronchial tree while the haematogenous theory suggests that the larynx becomes involved through the haematogenous route from other distant primaries rather than direct spread from the airway.37-38 Due to the fact that the bronchogenic mode of transmission is more common, chest x-rays should form part of the examination.37-38
Laryngeal TB is rare occurring in less than 1% of TB cases. Hoarseness is the most common symptom. Patients may also describe odynophagia, dysphagia, cough, otalgia and signs of stridor.3,34,37-45 The vocal folds (true followed by the false) are the most commonly affected sites and make up 50-70%, closely followed by the ventricular bands, which make up 40-50% of cases. The epiglottis, aryepiglottic fold, arytenoid, posterior commissure and subglottis make up 10-15% of cases of laryngeal TB. The anterior half of the larynx is affected twice as often as the posterior half.3
Clinical features in laryngeal TB vary, from ulcers on the true vocal folds to hypertrophic nodules and hyperaemia and oedema of the arytenoids and of the aryepiglottic folds. Broad based exophytic lesions without significant erythema and oedema may also be seen.22,39,42,45 Histopathological examination must be done to differentiate between cancer and laryngeal TB.3,34,42 Patients with laryngeal TB are treated with anti-tuberculin medications and demonstrate a quick clinical response and rarely require a tracheotomy to secure the airway.3,34
Nasal
Nasal TB is rare. The English literature has reported 26 cases during the 20th century. It is caused either by a primary infection or secondary to pulmonary disease.46 Common sites of involvement are the cartilaginous septum and the inferior turbinate. The lesions may present as ulcers or polyps. The lesions of the paranasal sinuses present as pale, polypoidal mucosa of the maxillary antrum or multiple polyps of the ethmoid. Bone involvement with fistula formation is rare.3,22 TB of the nasal cavity is painless and causes nasal obstruction and catarrh.3 Treatment for nasal TB is varied. Surgical excision, diathermy, cautery, lactic acid application and radium treatments were the early regimens. There could be recurrence with surgical excision. Since 1951 reported cases have been treated with anti-TB medications and no recurrences have occurred.46
Oral Cavity
Less than 3% of the TB cases involve the oral cavity.47,48 The bacteria can infect oral tissues and lymph nodes. Within the oral cavity, lesions occur in the soft tissues and supporting bone and in tooth extraction sites, and the tongue and floor of the mouth. They occur in the following order – tongue tip, tongue border and floor of the mouth, soft palate anterior tonsillar pillar and uvula and dorsum and base of the tongue. Oral lesions appear as painful ulcers, nodules, fissures and tuberculosis granulomas.22,41,49-59
The tuberculosis oral ulcerations may be solitary or multiple, occasionally painful and usually involves the dorsum of the tongue. The mature ulcer has an irregular outline and a rough or granular surface. The surrounding mucosa is erythematous and oedematous. The infection in the oral cavity requires mucosal injury and could result from pulmonary disease. The gingiva, dental sockets and buccal folds are commonly involved by direct inoculation. These lesions can be distinguished from carcinoma by histological examination.3,34,49-54,56-61 Primary tuberculosis lesions of the mouth which are seen in younger patients are generally painless and there may be regional lymphadenopathy present. When they become secondarily infected with bacteria from the oral cavity, they may become painful. Secondary TB is more common among older patients and is usually a complication of pulmonary disease.48-49,52,56-57,62
Tongue lesions are usually painful, grayish yellow, firm and well demarcated. Gingivitis tuberculous presents as irregular, nodular lesions that may cause more diffuse involvement.50,57,62
Due to the low prevalence of oral TB lesions it is often not considered in differential diagnoses. However, with the recent reversal in the incidence of TB it should always be included in the differential diagnosis of oral ulcerations as delay in the diagnosis may have serious consequences.49,50,53 Chemotherapy is used to treat TB of the oral cavity.3
Jaws
TB of the mandible and tempromandibular joint (TMJ) is rare. The incidence does not exceed 1.4% of all patients affected by the disease. Young patients with pulmonary involvement can present with TB of the mandible. TMJ TB can be a primary infection or a fistulous communication from TB otitis media. Trismus and a painful fluctuant swelling in front of the ear are the symptoms experienced.22
TB of the jaws is manifested as a tuberculosis granuloma or tuberculous osteomyelitis. Radiographically the tuberculosis granuloma presents as a periapical radiolucency involving a nonvital tooth. Pain and swelling of the affected area is present. The swelling later softens and ruptures intra-orally or extra-orally.
Sinus tracts are then present and trismus occurs when the mandible is affected. The spread of infection may occur through an extraction socket, mucosal tear associated with an erupting tooth, regional extension of a soft tissue lesion to underlying bone, or by haematogeneous spread. Apical osteitis, periodontitis with horizontal bone loss or a widespread destructive osteolytic lesion are some of the presentations. It may be mistaken for a dental abscess in the absence of systemic symptoms. The patient recovers with anti-tuberculous treatment. In tuberculous osteomyelitis complete drainage of the abscess and removal of necrotic bone is done in combination with anti-tuberculous chemotherapy. Although TB rarely affects the jaws, it should be considered in differential diagnosis of chronic joint and infectious bone disease since it continues to be a health problem in both developed and underdeveloped countries.

**Differential Diagnosis**

A differential diagnosis for oral TB should include malignancy, traumatic and aphthous ulcers, syphilis, sarcoidosis and deep mycotic infections. Differential diagnosis for TB of the jaw is pyogenic osteomyelitis, actinomycosis, neoplastic lesions or osteogenic sarcoma and lymphoma or secondary metastasis in the neck.

**Cervical Spine**

TB of the cervical spine occurs more often in prepubertal children than in adults. The commonest symptom of TB of the cervical spine is pain followed by dysphagia, dyspnoea and stridor due to pressure effects. Abscess formation presents as a retropharyngeal abscess, sternomastoid abscess or parotid mass. Large abscesses are treated surgically.

**Aural**

Aural TB affecting the middle ear cleft has dramatically decreased over the past 40 to 50 years. This could be due to the availability of specific bactericidal anti-tuberculous drugs, improvement in the public health services, massive inoculation of cattle with the virtual eradication of Bovine-strain TB, improvement in housing and widespread Bacille Calmette-Guérin (BCG) inoculation campaigns directed at babies and children of school age. Aural TB is usually found in children and young adults. Typical features are painless otorrhoea, central perforation, pale middle-ear granulations, severe hearing loss and facial paralysis. Bone necrosis and sequestration in the mastoid is commonly found. With superimposed infection there may be otalgia, foul-smelling infection, acute mastoid infection and fistulisation. Multidrug therapy is the treatment of choice while awaiting culture and sensitivity results.

**Salivary Glands**

TB of the salivary glands is rare and only about a hundred cases have been reported in the world wide literature. It can be central, with involvement of the intra-glandular lymph nodes, or diffuse, with involvement of the parenchyma. Parotid involvement presents as a firm, non-tender mass. Abscess formation and fistulisation may also occur. Seventh nerve palsy is rarely seen. The parotid gland is the most commonly involved followed by the submandibular and then sublingual gland. In the parotid the infection arises in the intra-parotid lymph nodes, the bacilli reaching the gland either via the duct or through the lymphatic channels.

Patients are generally well with no evidence of pulmonary involvement therefore TB infection is often indistinguishable from neoplasm. Pain manifests later and facial palsy is rare. Anti-tuberculosis chemotherapy is the standard treatment. Surgical intervention is avoided in these patients. TB of the salivary gland should always be included in the differential diagnosis of salivary gland tumour especially in the areas where TB is endemic. This would avoid unnecessary surgery for histological confirmation and anti-tuberculous medication would be sufficient to resolve the condition. Therefore the combination of fine needle aspiration cytology and molecular biology methods such as polymerase chain reaction should be used as initial diagnostic tools for the diagnosis of salivary gland TB.

**Pharynx**

Pharyngeal infection is slowly progressive and presents as a chronic nodular irregularity of mucosal surfaces. The two main sites of pharyngeal involvement are the nasopharynx and oropharynx. These are mostly primary infections. Nasal obstruction with rhinorrhea is the most common complaint. Cervical lymphadenopathy may accompany nasopharyngeal TB. Ulcerations and fibrosis of the tonsils make it difficult to distinguish between tonsillar TB and tonsillar carcinoma. Treatment with chemotherapy shows rapid improvement.
Eye
TB of the eye is rare and is found in about 1.4% of patients. The common site of occurrence is the posterior and anterior uveal tract. Primary or secondary involvement of the eye can occur. Primary disease is the result of direct inoculation by contaminated fingers, dust or droplet nuclei from sputum and is rare. This results in conjunctivitis, corneal ulcerations or abscess formation. The causative organism could be *M. tuberculosis* or *M. fortuitum*. In secondary TB infection of the eye the organism reaches the eye via the blood and this may be the only manifestation of the disease.\(^{57}\)

**Oral Health Considerations**

The risk of TB transmission from patients to oral healthcare workers is considered to be minimal.\(^{73}\) However, *M. tuberculosis* is uniquely hazardous to oral healthcare workers because of its airborne route of transmission, lack of effective vaccination, the long and tedious treatment regimen, presence of resistant strains and the long-term sequelae of the infection.

Historically, tuberculosis has been regarded as an occupational hazard for oral healthcare workers; at present persons who work with high-risk patients or in high prevalence communities are still considered at risk for new infection.

Standard precautions provide the fabric for strategies to prevent or reduce the risk of exposure to blood borne pathogens and other potentially infectious material. Surgical masks do not prevent inhalation of *M. tuberculosis* therefore standard precautions are inadequate to prevent the spread of this organism through droplet nuclei 1-5 microns in diameter and additional measures are necessary to prevent the spread of *M. tuberculosis*.\(^{73}\)

When an oral healthcare worker has to provide urgent dental treatment to patients with suspected or active TB, filtering face piece respirators (such as N95, N99 or N100 – certified by the CDC’s National Institute for Occupational Safety and Health (NIOSH) should be used to prevent inhalation of infectious droplet nuclei. An N95 respirator is at least 95% efficient in filtering 0.3 micrometers-diameter particles. The oral healthcare worker must be trained to use the mask to ensure adequate seal between the face and the edges of the mask. Differences between disposable respirators and surgical masks include fit against faced, wear time, testing and approval. Particulate respirators protect the user from inhaling particles, including small microorganisms (less than 10 micrometers in diameter).\(^{74}\)

In contrast, surgical masks protect against large particles generated by the user; protect the user’s mouth and nose from large particle droplet splash, spray or spatter that contain pathogenic microorganisms; and should be placed on coughing patients to limit potential dissemination of infectious respiratory secretions to others (that is cough etiquette). Surgical masks are not CDC/NIOSH-certified as respirators and do not protect the user adequately from inhaling airborne contaminants, including *M. tuberculosis*, because they have a looser fit and lower filtration efficiency than do the N95 respirators. The fit of most surgical masks allows a gap between the edge of the mask and face that permits inhaled air to flow around the sides of the mask.\(^{73}\) The magnitude of risk varies by setting, occupational group, and prevalence of TB in the community, patient population served in the setting, procedures performed and effectiveness of TB infection-control measures. Every setting in which services are provided to persons who have suspected or confirmed TB disease should have a TB infection-control plan. The probability of a person exposed to *M. tuberculosis* becoming infected depends on the concentration of infectious droplet nuclei in the air and the duration of exposure to a person with infectious TB disease.\(^{74}\) Environmental factors such as exposure in confined spaces, inadequate ventilation and recirculation of air containing infectious droplet nuclei further increase the likelihood of transmission.\(^{75}\)

Cases with positive smears are highly infectious. Prior to the AIDS epidemic it was accepted that pulmonary cavity formation was necessary for contagiousness. However, patients with AIDS and pulmonary TB may be highly contagious in the absence of cavitations and normal chest radiographs. This results in delayed diagnosis and a greater risk of nosocomial transmission.\(^{75}\)

There is a paucity of data linking dental instrumentation to the generation of droplet nuclei.\(^{76,77}\) Similarly, the reported incidence of tuberculin skin test conversion among oral healthcare workers is low.\(^{78-80}\) It can however be anticipated that oral healthcare workers and patients with infectious TB disease will generate droplet nuclei by coughing, sneezing, laughing and talking; therapeutic intervention could stimulate coughing and promote the generation of infectious particles. Since patients and oral healthcare workers share the same air space, the potential for the transmission of *M. tuberculosis* cannot be discounted.\(^{81}\) Although oral healthcare workers are not responsible for diagnosis and treatment of TB, they should be trained to recognise signs and symptoms (Table 1) to help with prompt detection. Infection control procedures at dental practices should include knowledge of the signs and symptoms of active TB, an updated medical history related to respiratory illness and referral of suspicious patients for medical evaluation.
Hand-washing must be done prior to and following patient contact, instruments must be sterilised and contaminated working surfaces must be disinfected with phenol and glutaraldehyde. Well-constructed, soft, pleated, high-filtration face masks must be worn when aerosols are produced during dental treatment. Masks must be kept dry to avoid microbes passing through.

Aerosols can be reduced by avoiding the use of water spray from the triplex syringe and by using a rubber dam and high volume suction. The probable transmission of MDR TB disease from patients to two oral healthcare workers has been documented in the United States, and there is evidence of TB disease transmission from an oral surgeon to 15 patients following extractions.82-83 The 2005 CDC guidelines for preventing the transmission of *M. tuberculosis* in healthcare facilities explicitly identify oral healthcare settings as outpatient settings in which patients with suspected or confirmed infectious TB disease are expected to be encountered.74 This inclusion is based on the assumption that patients with infectious TB disease may present in the dental setting for urgent or routine dental care and oral healthcare workers might share air space with persons with infectious TB disease or might come in contact with clinical specimens that contain *M. tuberculosis*.

Therefore, every oral healthcare facility should have a TB infection-control plan that is part of its written infection control/exposure control protocol. The TB infection-control component of an overall infection control/exposure control programme should be appropriate for the level of risk in the specific healthcare setting and should be based on a three-level hierarchy of administrative, environmental and respiratory-protection controls.74,82,84-85

**Infection Control Measures for TB in a Dental Setting**

TB infection control policies and protocols for implementing these control measures should be included in a dental setting’s overall TB infection control program and should be reviewed annually.

<table>
<thead>
<tr>
<th>Table 1: Patient history prompting suspicion of active TB</th>
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<td>1. Productive cough (&gt;2 weeks) – pulmonary TB.</td>
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<tr>
<td>2. Other symptoms (fever, chills, night sweats, fatigue, chest pain, loss of appetite and weight, weakness, coughing up blood).</td>
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<tr>
<td>3. Extra-pulmonary TB (occurs in 15% of cases).</td>
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<tr>
<td>4. Patients with TB and HIV infection – 40-75% have extra-pulmonary TB and pulmonary TB.</td>
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<tr>
<td>5. History of TB exposure and/or previous TB infection (active TB).</td>
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**Source:** Dawkins (2003)

The first and most important level in the TB infection-control program is the implementation of administrative controls which is the first line of defense and should reduce the risk of exposure of dental staff and patients to people with active TB (Table 2). These administrative controls are intended to reduce the risk of exposure to persons, who might have infectious TB disease, and are essential prerequisites for the effectiveness of environmental controls and respiratory-protection controls in all settings where
patients with suspected or confirmed TB disease are expected to be encountered.74 Although the overall risk of oral healthcare workers for exposure to a patient is probably low, every oral healthcare setting should conduct initial and ongoing (annual) evaluations of TB risk for the setting and determine the demographics of the patient population served in that setting.74 This will determine the types of administrative, environmental, and respiratory-protection controls that are needed for the particular setting. Consultation with the local or state health department must be done. Patients with signs and symptoms suggestive of TB should be given surgical masks or tissues and if none is available, they should be directed to cough into their sleeves, instructed in respiratory hygiene and cough etiquette (Table 3) and placed in an area away from other patients and staff members.86

Contact with patients with undiagnosed or unsuspected infectious TB disease is the primary risk of exposure to *M. tuberculosis* in the oral healthcare setting. A high index of suspicion and rapid implementation of precautions are essential to prevent and interrupt the transmission of *M. tuberculosis*. Specific precautions will vary depending on the setting, i.e. prevalence of TB in the community, patient population served and the type of services provided in a particular setting.82 The minimum requirements in a community-based oral healthcare setting is the implementation and enforcement of a TB infection-control protocol that provides (i) prompt identification of patients with suspected or confirmed infectious TB disease, (ii) separation of patients with suspected and confirmed TB disease from other oral healthcare workers and patients, and (iii) referral of patients with suspected and confirmed TB disease for a medical evaluation and/or required oral healthcare procedures to a facility with appropriate environmental controls and respiratory protection controls.82 An essential part of administrative controls in a TB infection-control programme is the education and training of oral healthcare workers which include all paid and unpaid persons working in the oral healthcare setting who have the potential for exposure to *M. tuberculosis* through air space shared with persons with suspected or confirmed infectious TB disease.82 Risk classification for the setting will determine the need for and frequency of TB screening for oral healthcare workers. Oral healthcare facilities are considered medium risk settings. All oral healthcare workers should receive baseline TB screening at the time of employment. Follow-up TB screening should be performed annually. Oral healthcare workers with positive results should be evaluated promptly for TB disease. Radiographs are also important as part of the evaluation. Preventive therapy should be offered to all personnel with baseline-positive results. Personnel with TB disease should be excluded from the workplace until they are receiving adequate therapy, their cough has resolved and their sputum smears are negative.74 The concept of universal precautions is the key element of infection control in dentistry since medical history and examination cannot reliably identify all patients or carriers of infections. All patients must therefore be regarded as potentially infectious. Deferral of non-emergency care may be indicated when patients present for dental treatment with diseases such as TB and they should then be treated when they are non-contagious.

Patients requiring urgent dental treatment should be referred to a facility with TB engineering controls and a respiratory protection programme. Patients should wear a surgical mask or be instructed to cover mouth and nose when coughing or sneezing when they are not being evaluated. In order to minimise the spread of respiratory or other diseases in dentistry emphasis should be placed on vaccination, use of particulate respirators and adequate ventilation. The BCG vaccine is an effective measure that can help control the spread of TB and should be administered to oral healthcare workers in geographic regions or clinical settings where there is a high prevalence of TB. In addition the surgery should have good ventilation; aerosols should be controlled by high volume externally vented aspirators and wearing of particulate respirators. Facemasks routinely used by oral
healthcare workers may not always provide an effective means of preventing infection. Oral healthcare workers need to be alert to signs and symptoms of TB and refer such individuals for appropriate medical healthcare. A TB screening programme should be established for the protection of both workers and patients. The prevalence of TB in the community or patient population indicates a potential risk for occupational exposure to TB. Tuberculin skin testing data should be evaluated regularly to enable the dental personnel to evaluate the effectiveness of current infection control practices.

The resurgence of TB as a public health problem, the explosive outbreaks of TB among AIDS patients, reports of transmission to staff and the emergence of drug resistant strains have refocused attention on the risk to oral healthcare workers and has rekindled interest in this disease among oral healthcare workers. However, much research has focused on pulmonary and extra-pulmonary TB involving the abdomen and spine and there is a paucity of literature on the head and neck region. Extra-pulmonary presentations form a significant proportion of new cases concomitant with HIV epidemic. The increase in numbers of HIV seropositive individuals and the late diagnosis of TB in these patients because of atypical signs and symptoms, suggest that oral healthcare workers may be unknowingly treating infected patients who pose a risk. The generation of aerosols in modern dentistry is a recognised risk for transmission of infection which is droplet spread. Systemic symptoms may be absent and oral lesions may be the first manifestation of the disease. Therefore oral healthcare workers need to be aware of TB in the head and neck region and its varied manifestations.

References


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