

Tuberculosis and oral healthcare provision

S. Clough,^{*1} A. Shaw² and C. Morgan³

Key points

Discusses tuberculosis disease and its management in the UK.

Provides an overview of key concepts to support the delivery of oral healthcare for this patient group.

Provides greater awareness of health and safety responsibilities for both employers and employees.

Tuberculosis (TB) is a preventable and curable infection, but remains a significant cause of death. The dental team is likely to encounter patients with a history of TB, however, at present there is limited guidance available to inform the provision of oral healthcare for this patient group. This may lead to confusion with delays in care. There is a potential health risk posed to patients and co-workers by a member of the dental team who becomes infected. TB has the potential to be a major issue for oral healthcare in the United Kingdom (UK). This paper discusses the implications for both patient care and management of the dental team.

Background

Tuberculosis (TB) is a preventable and curable infection caused by mycobacteria, yet remains a significant cause of death.¹ TB is predominantly caused by mycobacterium tuberculosis² and is a major issue for oral healthcare due to its mode of transmission, the development of drug resistant strains and newly emerging risk factors for the disease. This paper discusses the potential implications for both patient care and management of the dental team.

TB most commonly affects the lungs, pleural cavity, mediastinal lymph nodes or larynx (pulmonary TB), however, it can infect many parts of the body (extra-pulmonary TB),³ with formation of characteristic caseating granulomata.⁴ Of all types, pulmonary TB poses the greatest risk of transmission within the dental setting due to its infectivity through droplets in aerosol caused by coughing and splatter.⁵

TB is a notifiable disease² in the UK, meaning that medical practitioners and laboratories have a statutory requirement to inform the local health protection team within three days of a suspected or confirmed case. Over the last ten years, although there has been a decline in the overall incidence of TB, the rate has remained high in the UK compared to most other western European countries.^{6,7} During 2016, 5,664 cases were notified in England and as in previous years, London accounted for the highest proportion of cases (39.0%).⁶ In 2015, approximately 343 deaths were directly

attributable to TB in England and Wales.^{6,8} The majority (73.0%) of cases occur among people born outside the UK, following migration from areas of the world where TB is more common, including South Asia and sub-Saharan Africa.⁶ Pre-entry screening of migrants to the UK for active pulmonary TB from high incidence countries has been in place for more than ten years, however, the majority of TB cases in the non-UK born population (60.0%) occur among settled migrants (Table 1).⁶ TB remains concentrated in the most deprived communities.⁶

Table 1 High risk groups for TB infection^{4,6,9,14}

Social	Medical
Low socio-economic status	HIV/AIDS
Minority ethnic groups	Diabetes
Recent migration from country with high incidence of TB	Malnutrition
Contact with people with established TB infection	Immunosuppression: Solid organ transplant Chemotherapy Treatment with biologic agents
Alcohol and drug misuse	Haematological malignancy
Smoking	Jejunioileal bypass
No fixed abode	Gastrectomy
Poor access to healthcare	Chronic kidney disease or haemodialysis
	Silicosis

¹Locum Consultant in Special Care Dentistry, Barts Health Dental Hospital; ²Locum Consultant in Respiratory Medicine, Whittington Hospital; ³Consultant in Restorative Dentistry, Barts Health Dental Hospital

*Correspondence to: Stacey Clough
Email: Stacey.clough@bartshealth.nhs.uk

Refereed Paper.

Accepted 20 March 2018

Published online 15 June 2018

DOI: 10.1038/sj.bdj.2018.430

Diagnosis

The onset of TB can be subtle and often makes diagnosis complex. A number of clinical tests are used as outlined in Table 3. False positive results are not uncommon and at the clinical level, can be a source of confusion for patients and the dental team.

TB treatment

People with TB are cared for by a specialist team which in view of the associated risk factors, is often multi-disciplinary, spanning both health and social care sectors. Delays in diagnosis and treatment can result in a less favourable outcome for the individual and increased risk of spread to others, therefore treatment is often started in view of the clinical picture without culture results.⁴

Unless there is an exceptional need, such as homelessness, with a requirement for directly observed therapy, people with a TB diagnosis are not usually admitted to hospital

Table 2 Summary of clinical and diagnostic features of latent and active pulmonary TB^{4,10,11}

Feature	BCG Vaccinated	Latent TB	Active TB		Treated TB
Symptoms	None	None	Asymptomatic (25%)	Symptomatic (75%) Persistent cough >3 weeks Haemoptysis Pain on breathing Malaise Weight loss Night sweats	None
Risk of infection	None	None	Yes – droplets in aerosol		None

Clinical features

TB infection can be described as latent or active. The majority of people infected with TB do not have any symptoms, known as latent TB.^{3,10} Throughout their lives, most people do not experience active disease and cannot therefore spread the infection.¹⁰ Approximately 10% of cases of latent TB will develop active TB.¹⁰ Active TB from the point of infection is less common. The features of latent and active

pulmonary TB are outlined in Table 2.

TB lesions of the oral cavity are uncommon and consequently are often overlooked in the differential diagnosis of oral lesions. There have been a number of case reports in the literature. Oral lesions are frequently described as a stellate ulcer. However, the clinical picture is variable, with facial swelling, gingival enlargement, patches and lesions of the jaws such as tuberculous osteomyelitis, or radiolucencies of the bone also described.¹²

Table 3 Summary of TB diagnostic investigations^{4,13-18}

Investigation	Description	BCG vaccinated	Latent TB	Active TB	Treated TB	Comments
Tuberculin skin test (eg Mantoux Test)	Intra-dermal tuberculin (an antigen mixture) is injected into the skin of the arm and observed within 48 to 72 A positive induration reaction is observed in an individual with prior TB exposure	Positive	Positive	Positive	Positive	May be a false positive in those who have received the BCG vaccine or BCG cancer immunotherapy The Heaf test has now been replaced by the Mantoux test in the UK
Interferon Gamma Release Assays (IGRA) (eg QFT-GIT or T spot Tests)	A blood test is taken to measure the amount of Interferon- γ released from lymphocytes when exposed to specific antigens A positive result indicates that the individual has prior TB exposure	Negative	Positive	Positive	Positive	Preferred test in people with history of BCG vaccination or BCG cancer immunotherapy
Chest radiograph	Anterior-posterior chest radiograph used to detect structural abnormalities	Normal	Normal	Consolidation Cavitation Fibrosis Calcification	Varies with pattern of disease	Used as a screening tool rather than definitive diagnosis
Microbiology	Most commonly a sputum sample is taken and tested for the presence of acid-fast bacilli and culture A positive culture for <i>M. tuberculosis</i> confirms TB infection	Negative	Negative	Positive	Negative	Acid-fast bacilli test is not diagnostic for TB as it is non-specific Culturing the sample is specific however takes up to 12 weeks
Histology	Caseating granulomas are typically observed in TB but not diagnostic	Negative	Negative	Positive	Positive	Samples are more routinely assessed in non-pulmonary TB Granulomata are also seen in other conditions such as foreign body reactions

for treatment. Treatment typically consists of six months of anti-microbial therapy on an out-patient basis. This involves eight weeks of initial therapy of rifampicin, isoniazid, pyrazinamide combined with ethambutol or, rarely, streptomycin followed by a continuation phase of 16 weeks rifampicin and isoniazid. Alongside this, patients are usually also prescribed pyridoxine to prevent neuropathy.¹⁴ The level of infectivity is considered to reduce significantly after two weeks of antimicrobial therapy.¹⁴ The TB team will assess the need for investigations and treatment of close contacts.¹⁴

The social factors highlighted in Table 1 are also associated with poor treatment compliance, with not only risk of further transmission, but also the development of drug resistance within the population.¹⁴ In the UK, 1.7% of cases are due to strains resistant to treatment with the first line drugs rifampicin and/or isoniazid.⁶ Treatment of drug resistant TB is on the basis of laboratory sensitivity testing with prolonged follow-up.⁴

Implications for patient care and the dental team

The dental team has an obligation to provide the same high standard of care for patients with infectious diseases as available to any other patient.¹⁹ A number of considerations must be made in relation to TB. This includes infection control policy, staffing, vaccination, medical history, personal protection, decontamination and treatment modality.

Infection control policy

Dental care providers must have a tailored written infection control policy which identifies procedures to be followed. This should include a protocol for managing patients with suspected or confirmed TB.²⁰ Standard infection control measures with reference to TB are outlined by the British Dental Association.¹⁹

Staffing

The transmission of TB in healthcare settings to both patients and healthcare workers has been reported worldwide. The dental team is no exception.²¹ This can lead to inconvenience and expense brought by patient notification exercises, in addition to widespread anxiety and high costs to the health service.²²

From an employer's perspective, the Department of Health requires that all new

healthcare workers who will be in contact with patients should not start work until they have completed standard health clearance checks. It is recommended that this is publicised in job descriptions and application packs.²²

The standard health clearance check includes tests for TB disease and evidence of immunity. It should include assessment of the individual, discussion of signs/symptoms and their family history of TB as well as documented evidence of tuberculin skin testing or interferon gamma testing within the last five years and/or checking of a BCG (Bacillus Calmette-Guerin) scar by an occupational health professional.²² If a new employee has not had a BCG vaccination or if they have migrated from countries where TB is endemic or a country of low incidence but results show a positive tuberculin skin test or interferon-gamma test, they should have a medical assessment before starting work. Clinical students and locum staff workers who have contact with patients or clinical materials such as specimens must also be screened for TB to this same standard.²²

Healthcare workers will be at continued risk of exposure either on a personal or professional basis, therefore the long-term benefit of one-off testing of new healthcare workers has been questioned. In North America, the Centres for Disease Control and Prevention (CDC) recognises this and suggests that all dental settings should conduct an annual assessment of the risk of TB transmission based on the community profile. It classifies risk to healthcare workers based on the likely number of contacts with TB seen annually as low, medium or potential ongoing transmission, which dictates the frequency of testing.²³ It acknowledges that most dental settings are considered to be low risk to healthcare workers, requiring TB testing at baseline and if exposure occurs.^{20,22} However, it would be reasonable to consider community, hospital, prison and mobile dental services that provide care to some of the more vulnerable groups as outlined in Table 1, at a higher risk than other dental settings when located in high risk areas. In the UK the Department of Health requires healthcare workers who may have been exposed to TB to seek professional advice regarding testing, which removes the need for repeat testing²² despite a high proportion of people having no symptoms of infection.^{3,10} Therefore, a general schedule for screening among professional groups at a higher risk does not exist in the UK at present.

Employers should be made aware of the settings with increased risk of exposure to TB through occupational health services. These environments pose increased risks to HIV-positive healthcare workers.²² Members of the dental team who are HIV positive should have medical and occupational assessments of TB risk completed.

Vaccination

The BCG vaccine is no longer given routinely in the childhood vaccination schedule to prevent TB. Though it is offered to babies at birth born in areas where TB rates are high or whose parent or grandparent were born in a high incidence country (>40/100,000), including some parts of inner London. It is less effective in adults and is therefore reserved for individuals considered at a particularly higher risk, such as healthcare workers who are tuberculin skin test or interferon gamma test negative and have not been previously vaccinated,³ but are in contact with patients and/or clinical specimens. This vaccine is also used as an immunotherapy in the treatment of certain cancers, in particular bladder cancer and has been reported to give rise to misleading false positive TB results.²⁴

If a healthcare worker declines BCG vaccination, the risks should be explained and it is advised that they should usually not work where there is a risk of exposure to TB.²² The employer will need to consider each case individually.

Medical and social history

A medical and social history should be obtained for all new patients and updated at regular intervals.¹⁹ This should include questions pertaining to risk factors and diagnosis of TB. Consideration should be given to language support in order to ensure a thorough history is obtained.

Due to respiratory irritation, patients may find delivery of oral healthcare uncomfortable at different stages of infection. Patients and staff may show typical signs and symptoms of pulmonary TB (Table 2), however, they may not have received appropriate medical care, therefore advice and referral for assessment by their general medical practitioner (GMP) is prudent. The medical history may also identify asymptomatic patients with known latent TB, those with active TB and those who have completed treatment.²⁵

Table 4 Pulmonary TB Dental Care Pathway Summary^{23,27}

Category	Elective treatment	Emergency treatment
Active TB	Postpone until TB therapy is complete Infection risk is significantly reduced after the completion of 2 weeks of TB therapy is complete	Where it is not possible to wait, proceed with additional precautions
Signs and symptoms of TB but no diagnosis	Refer to medical practitioner for assessment Postpone until diagnosis and therapy is complete	Refer to medical practitioner for assessment Where it is not possible to wait, proceed with additional precautions
No TB diagnosis but positive tuberculin skin test	Refer to medical practitioner for assessment Postpone until diagnosis and any therapy is complete	Refer to medical practitioner for assessment Where it is not possible to wait, proceed with additional precautions
Latent TB	Confirm status with medical practitioner No additional precautions	Confirm status with medical practitioner No additional precautions

Table 5 Summary of additional precautions in active and suspected TB^{14,19,23,25,27}

Additional precaution	Comment
Minimise aerosol	Avoid handpieces with water spray Turn on high volume suction prior to handpieces (if necessary) Use rubber dam when possible
Environment	Negative pressure room (ideal) Well ventilated, not with air conditioning
Personal protection	FFP3 face mask Promote respiratory hygiene
Timing	Infection risk is significantly reduced after the completion of 2 weeks of TB therapy End of the session to minimise risk of transmission Keep waiting time in public area minimal
Team	Vaccinated members of staff
Modality	May be limited to treatment under local anaesthesia Treatment under conscious sedation or general anaesthesia warrants further discussion with local infection control and anaesthetic teams

Although dentistry is not specifically highlighted, the recent National Institute for Health and Care Excellence (NICE) guidelines advise that when caring for people that may have active TB, aerosol-generating procedures should only be carried out in an appropriately engineered and ventilated area, ideally a negative pressure room.¹⁴ This is an isolation area where room air is sucked out through a filter creating a negative pressure. The inflow of air into the room therefore prevents the escape of contaminated air to surrounding areas and the ventilation in the room dilutes airborne pathogens.²⁶ Although not routinely available within the dental setting, such rooms are available in hospitals, including in accident and emergency departments as a dedicated facility for patients with a known or suspected infectious disease.²⁶ From a practical perspective

the dental treatment that could be provided in such a facility would be quite limited due to the specialised nature of dental equipment, therefore in the authors' opinion it would not be reasonable to postpone elective dental care.

A summary of the management considerations and additional precautions for these different patient categories are outlined in Tables 4 and 5 respectively.

Patients may be taking medications for TB treatment, which may impact on dental treatment as outlined in Table 6. Of particular relevance, as many of these drugs can contribute to pancytopenia and hepatotoxicity, consultation with the TB specialist and a review of recent blood tests is considered prudent before invasive dental treatment. Peripheral neuropathy is also a common issue, which could present in the head and neck region

and potentially lead to complexities in oral comfort, hygiene and treatment provision.

Patients with extra-pulmonary involvement of the central nervous system or heart may be initially receiving high dose glucocorticoid which is reduced over four to eight weeks.^{14,28} Glucocorticoid cover before surgery remains debateable,²⁹ however, consideration of glucocorticoid cover should be included in the discussion with the TB specialist should the need for emergency dental treatment arise.

Personal protection

As healthcare professionals, we have a duty to inform staff and patients of basic cough etiquette in order to reduce the risk of transmission. This includes covering the mouth and nose with a barrier when coughing or sneezing, such as with a tissue and disposal in a waste receptacle. If this is not possible, the mouth and nose should be covered with a bend of the elbow or hands, which should be cleaned immediately with soap and water or alcohol-based solution. There is little evidence whether surgical masks worn by the affected individual reduce the transmission of TB.³⁰

Irrespective of setting, the dental team has a duty to ensure that infection control procedures are followed as outlined in an infection control policy in line with current recommendations which should be considered routine for all patients during treatment.²⁰ One aspect of this is personal protection including hand hygiene, wearing gloves and clothing with access to the forearms, in addition to the use of disposable aprons, eye protection and face masks.

A variety of face masks are available to reduce the risk of respiratory infections. Table 7 shows a standard surgical mask,³¹ worn to protect the patient and clinician from cross infection due to large particles in splashes. They do not provide full respiratory protection against smaller suspended droplets and aerosols as is required in the prevention of transmission of active TB.¹⁹ When aerosol generating procedures are carried out in people with active TB, healthcare workers are advised to wear a mask which provides a higher level of filtering ability over a longer period of time.^{19,32} Filtering face pieces (FFP) FFP1 –FFP3 are available and the Health and Safety executive (HSE) advises that these masks are fit tested.³² NICE guidance¹⁴ offers limited information in respect of protective equipment for healthcare workers; however it is stated that staff should

wear FFP3 masks during contact with a person with suspected or known multidrug-resistant TB while the person is thought to be infectious. This mask provides the highest level of filtering capability and can be fitted with or without an exhalation valve for comfort, as shown in Table 7. Irrespective of type, masks are single use items and should be changed after each patient.¹⁹ In order to ensure quality of manufacture, masks and filtering face pieces must meet HSE standards, and the appropriate European Standards of EN14683:2005 and EN149:2001 respectively.³²

Decontamination

Medical equipment has not been involved in the transmission of TB.^{20,23} Compliance with the Department of Health's Decontamination Health Technical Memorandum 01-05³⁵ (HTM 1-05) is considered sufficient for protection against transmission of TB in the dental setting²¹ with no additional processing procedures.

Treatment modality

Where emergency treatment is required in cases of active TB, realistic options for dental care may be limited to treatment under local anaesthesia. Treatment under conscious sedation or general anaesthesia would be complex for the patient with active pulmonary TB as they may be acutely unwell, malnourished and often anaemic with bronchiectasis and compromised lung function.³⁶

If general anaesthesia is required, planning with anaesthetic and theatre staff is essential. Additional care, such as humidification of the breathing system may be indicated to reduce the risk of blockage of endotracheal tubes with mucus.³⁷ It is recommended that cases with a high risk of cross infection are scheduled last on the operating list to minimise risk. Where this is not possible, the Hospital Infection Society advises that a plenum-ventilated operating theatre should require a minimum of 15 minutes before proceeding to the next operation.³⁸

In the unlikely event that treatment under conscious sedation is planned, further discussion with local infection control and anaesthetic teams is warranted with consideration given to risk of respiratory depression, the need for increased oxygenation and avoidance of drug interactions with concurrent TB treatment.

Table 6 Summary of standard medications used in TB therapy with considerations for dental practitioners²⁸

Drug	Potential relevant side-effects	Potential relevant interactions
Rifampicin	Altered body secretions: orange tinted saliva Anaemia Leucopenia Thrombocytopenia Adrenal insufficiency Hepatotoxicity	Accelerated metabolism and reduced plasma concentration of: Benzodiazepines Codeine Diclofenac Doxycycline (recommended increased dose of doxycycline) Fluconazole Ketoconazole Itraconazole (manufacturer advises to avoid concomitant use) Clarithromycin
Isoniazid	Agranulocytosis Aplastic anaemia Hepatotoxicity Neuropathy	Possibly reduced plasma concentration of ketoconazole
Pyrazinamide	Photosensitivity Anaemia Thrombocytopenia Splenomegaly Hepatotoxicity	–
Ethambutol	Ocular toxicity	–
Streptomycin	Ototoxicity	Increased risk of nephrotoxicity when aminoglycosides given with polymyxins or amphotericin
Pyridoxine	Sensory neuropathy (prolonged high dose use)	–

Table 7 Face mask designs

Mask	Design	Cost (£)
	Standard surgical mask ³¹	0.14
	FFP3 with exhalation valve ³³	0.75
	FFP3 without exhalation valve ³⁴	0.60

Conclusion

The re-emergence of TB is a significant public health problem in the UK and for service providers, warranting careful consideration by all.

Employers must be aware of their legal obligations in the recruitment and care of staff with a history of TB, in addition to their responsibility towards the protection of both staff and patients through adherence to occupational health policy. A local infection control policy should be available to the dental team.

Patients with latent TB do not require additional clinical precautions to be taken in the delivery of their care. Patients with active TB often have additional medical complications. When emergency dental care is required in active infection, referral to secondary care is appropriate. Hospital staff should have arrangements in place to care for this group, including access to a negative pressure room and FFP3 masks. Members of the dental team working with vulnerable groups in high risk areas of the UK may benefit from access to FFP3 masks in case of an encounter with a TB positive patient. In addition to our direct role in the safe oral healthcare provision for this group, as allied healthcare professionals with high numbers of patient contacts on a daily basis, we also have a duty to raise awareness of TB and identify cases in the effort to eliminate this preventable disease.

- World Health Organization. Tuberculosis. Fact Sheet No. 104. 2018. Available at <http://www.who.int/mediacentre/factsheets/fs104/en/> (accessed March 2018).
- Public Health England. Infectious Diseases and Health Protection: Tuberculosis (TB) and other mycobacterial diseases: diagnosis, screening, management and data. 2017. Available at <https://www.gov.uk/government/collections/tuberculosis-and-other-mycobacterial-diseases-diagnosis-screening-management-and-data> (accessed March 2018).
- Public Health England. Chapter 32: Tuberculosis. In *Immunisation Against Infectious Disease. The Green Book*. 2013. Available at <https://www.gov.uk/government/publications/tuberculosis-the-green-book-chapter-32> (accessed March 2018).
- Longmore M, Wilkinson I B, Baldwin A, Wallin E. Chapter 9: Infectious Diseases: Tuberculosis (TB). In *Oxford Handbook of Clinical Medicine. Ninth Edition*. pp. 372–447. Oxford University Press, 2014.
- Bagg J. Tuberculosis: a re-emerging problem for health care workers. *Br Dent J* 1996; **180**: 376–381.
- Public Health England. Tuberculosis in England 2017 report (presenting data to end of 2016). 2017. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/686185/TB_Annual_Report_2017_v1.1.pdf (accessed June 2018).
- Public Health England. WHO estimates of tuberculosis incidence by country, 2016. 2018. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/677927/WHO_estimates_of_tuberculosis_incidence_by_country__2016.pdf (accessed June 2018).
- Public Health England. Tuberculosis mortality and mortality rate, England and Wales, 1913–2013. 2014. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/363056/Tuberculosis_mortality_and_mortality_rate.pdf (accessed March 2018).
- Lönnroth K, Jaramillo E, Williams B G. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. *Soc Sci Med* 2009; **68**: 2240–2246.
- Centre for Disease Control and Prevention. TB Elimination: The Difference between Latent Infection and TB Disease. 2014. Available at <http://www.cdc.gov/tb/publications/factsheets/general/lbtbandinfectvetb.pdf> (accessed March 2018).
- Lawn S D, Alimuddin Z I. Tuberculosis. *Lancet* 2011; **378**: 57–72.
- Carter E, Chandarana P, Duggineni S, Nasser N, Bridle C.. Case Series of extra-pulmonary tuberculosis presenting as facial swelling. *Br Dent J* 2015; **218**: 519–522.
- Hoang N B, Sy D N, Nhung N V, Tiemersma E W, Borgdorff M W, Cobelens F G. National Survey of tuberculosis prevalence in Vietnam. *Bull World Health Organ* 2010; **88**: 273–280.
- National Institute for Health and Care Excellence. Tuberculosis. 2016. Available at <http://www.nice.org.uk/guidance/ng33> (accessed March 2018).
- Health Protection Network. Tuberculosis: Clinical diagnosis and management of tuberculosis, and measures for its prevention and control in Scotland. Health Protection Network Scottish Guidance 5. Glasgow: Health Protection Scotland, 2008.
- Centre for Disease Control and Prevention. Fact Sheet. Testing for Tuberculosis. Available at http://www.cdc.gov/tb/publications/factsheets/testing/tb_factsheet.pdf (accessed March 2018).
- Centre for Disease Control and Prevention. Fact Sheet. TB Elimination: Tuberculin Skin Testing. Available at <http://www.cdc.gov/tb/publications/factsheets/testing/skintesting.pdf> (accessed March 2018).
- Centre for Disease Control and Prevention. Fact Sheet. TB Elimination: Interferon-Gamma Release Assays (IGRAs) – Blood Tests for TB Infection. Available at <http://www.cdc.gov/tb/publications/factsheets/testing/igra.pdf> (accessed March 2018).
- British Dental Association. Infection Control. 2017. Available at <https://bda.org/dentists/advice/ba/Documents/Infection%20control.pdf#search=infection%-2520control> (accessed March 2018).
- Cleveland J, Robison V A, Panlili A. Tuberculosis epidemiology, diagnosis and infection control recommendations for dental settings. An update on the Centres for Disease Control and Prevention guidelines. *J Am Dent Assoc* 2009; **140**: 1092–1099.
- Merte, J L, Kroll C.M, Collins, A S, Melnick A L. An epidemiologic investigation of occupational transmission of Mycobacterium tuberculosis infection to dental health care personnel Infection prevention and control implications. *J Am Dent Assoc* 2014; **145**: 5.
- Department of Health. Health clearance for tuberculosis, hepatitis B, hepatitis C and HIV: New healthcare workers. 2007. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/382152/health_clearance_tuberculosis_hepatitis_hiv.pdf (accessed March 2018).
- Jensen P A, Lambert L A, Iademarco M F, Ridzon R. Centres for Disease Control and Prevention. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005. *MMWR Recomm Rep* 2005; **54**: 1–142.
- Lamm D L. Bacillus Calmette-Guerin immunotherapy for bladder cancer. *J Urol* 1985; **134**: 40–47.
- Department of Health. Health Building Note 01–04. Supplement 1. Isolation facilities for infectious patients in acute settings. 2013. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/148503/HBN_04-01_Supp_1_Final.pdf (accessed March 2018).
- Department of Health. Health Building Note 00–09. Infection control in the built environment. 2013. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/170705/HBN_00-09_infection_control.pdf (accessed March 2018).
- Scully, C, Dios, P D, Kumar N. *Special Care in Dentistry*. First Edition. Oxford: Elsevier, 2007.
- Joint Formulary Committee. British National Formulary. 2018. Available at <https://www.bnf.org/> (accessed March 2018).
- Gibson N. Ferguson J W. Steroid cover for dental patients on long-term steroid medication: proposed clinical guidelines based upon a critical review of the literature. *Br Dent J*. 2004; **197**: 681–685.
- World Health Organisation. WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households. 2009. Available at http://apps.who.int/iris/bitstream/handle/10665/44148/9789241598323_eng.pdf;jsessionid=CCD8A70AF02DA08BB8592C9AB-3787A29?sequence=1 (accessed March 2018).
- NHS. Universal: Standard surgical mask image. 2018. NHS Supply Chain. Available online: <http://my.supplychain.nhs.uk/Catalogue/product/bwm114> (accessed June 2018).
- Health and Safety Executive. Respiratory protective equipment at work. 2013. Available at <http://www.hse.gov.uk/pUbns/priced/hsg53.pdf> (accessed March 2018).
- Universal: FFP3 with exhalation valve. 2018. NHS Supply Chain. Available online: <http://my.supplychain.nhs.uk/Catalogue/product/btp182> (accessed June 2018).
- Universal: FFP3 without exhalation valve. 2018. NHS Supply Chain. Available online: <http://my.supplychain.nhs.uk/Catalogue/product/btp180> (accessed June 2018).
- Department of Health. Decontamination Health Technical Memorandum 01–05: Decontamination in primary care dental practices. 2013. Available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/1706_89/HTM_01-05_2013.pdf (accessed March 2018).
- Jackson T A, Thomas J M. Tuberculosis: The Implications for Anaesthesia. *South Afr J Anaesth Analgesia* 2013; **19**: 301–305.
- Mercer M. Update in Anaesthesia. Anaesthesia for the patient with respiratory disease. Available at http://e-safe-anaesthesia.org/sessions/02_05/pdf/Respiratory-Disease-and-Anaesthesia.pdf (accessed March 2018).
- Association of Anaesthetists of Great Britain and Northern Ireland. Infection Control in Anaesthesia. 2008. Available at https://www.aagbi.org/sites/default/files/infection_control_08.pdf (accessed March 2018).