HSA

An tÚdarás Sláinte agus Sábháilteachta
Health and Safety Authority

Guidance on Occupational Hazards **in Dentistry**

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Contents

Introduction

Dental healthcare professionals (DHPs) may be exposed to a variety of workplace hazards in the course of performing their functions. The type and degree of exposure is dependent upon:

- Type of services provided
- Types of service users
- Specific tasks performed

Section 19 of the Safety, Health and Welfare at Work Act 2005 (2005 Act) requires employers to identify the hazards in the place of work, assess the risks presented by those hazards and be in possession of a written assessment of the risks to the safety, health and welfare at work of employees. Section 20 calls for a written Safety Statement based on the Section 19 written risk assessments, specifying the manner in which workplace health and safety will be secured and managed, including (but not limited to):

- The hazards identified and the risks assessed
- The protective and preventative measures taken

The aim of this guide is to assist in the systematic identification of occupational hazards in dentistry and to highlight protective and preventative measures that might be adopted in order to mitigate the risks posed to workers to as low a level as reasonably practicable.

Who is at Risk?

All dental healthcare professionals are potentially affected, including:

- the dentist;
- auxiliary dental workers (for example nurses, therapists, hygienists, technicians); and
- others at the place of work (for example service / maintenance personnel).

Legislation

For the purpose of this guide, the most relevant health and safety legislation, codes of practice and standards are:

- The Safety, Health and Welfare at Work Act 2005 (S.I. No. 10 of 2005)
- The Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016
- Amendments to the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016, in particular "Control of Artificial Optical Radiation at Work" and "Pressure Systems"
- The Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (S.I. No. 619 of 2001), particularly Regulations 4 &

- The Safety, Health and Welfare at Work (Biological Agents) Regulations 2013 (S.I. 572 of 2013)
- European Union (Prevention of Sharps Injuries in the Healthcare Sector) Regulations 2014 (S.I. 135 of 2014)
- EC (Carriage of Dangerous Goods by Road and Use of Transportable Pressure Equipment) Regulations 2011 to 2015 as may be amended from time to time

Relevant Codes of Practice Related to Health and Safety Legislation

- 2016 Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (as amended)
- 2013 Code of Practice for the Safety, Health and Welfare at Work (Biological Agents) Regulations 2013
- Dental Council Code of Practice "Infection Prevention and Control" 2015

Relevant Standards

- ISO 7494-1:2011 Dental Units: General requirements and test units.
- ISO 4073:2009 Location of dental equipment in the working area of the oral healthcare provider.

Hazards / Risk Management

With respect to the 2005 Act requirement to secure and manage workplace health and safety, Annex C of I.S. OHSAS 18002:2008 divides occupational hazards into 4 categories:

1. Physical

2. Chemical

3. Biological

4. Psychosocial

Hazard identification should aim to determine proactively all sources, situations or acts (or a combination of these) arising from an organisation's activities. Therefore the hazard identification processes should be applied to the following:

- all non-routine as well as routine activities (for example periodic, occasional and emergency);
- all persons having access to the workplace (for example patients, visitors, contractors, delivery personnel,);
- human behaviour, capabilities and other human factors;

- infrastructure, equipment and materials at the workplace (whether provided by the organisation or others); and
- the design of work areas, processes and operating procedures and their adaptation to human capabilities.

For the purpose of this guide, routine dental activities that may present a risk to dental healthcare professionals are discussed. These are listed below (readers are reminded that this is a non-exhaustive list):

1. Physical hazards:

a) Musculoskeletal (i.e. posture)

b) Ionising radiation

c) Non-ionising radiation

d) Pressure systems

2. Chemical hazards:

a) Anaesthetics

b) Amalgam

c) Acrylate and its compounds

d) General compressed gases

e) Latex

3. Biological hazards:

a) Blood/saliva/tooth fragments

b) Sharps

c) Healthcare risk waste

d) Legionella bacteria

4. Psychosocial hazards:

a) Work-related stress

Other hazards which may be relevant in a dental practice but are not included in this guide are listed below (non-exhaustive list). Information on these hazards is available on the Health and Safety Authority website at www.hsa.ie.

- Electricity
- Slips/trips/falls
- Display screen equipment
- Fire
- Patient handling
- Workplace vehicles / driving for work
- Radon
- Noise
- Work-related violence and aggression
- Bullying at work

Physical Hazards

1. Musculoskeletal (i.e. posture)

During dentistry procedures, the dentist's posture is strained, which induces stress injury on the musculoskeletal system. This occurs in 37.7% of work time (Ayatollahi, 2012).

The main factors associated with any task risk assessment are:

- Static positions that may be required (defined as "working posture maintained longer than four seconds; this applies to slight or non-existent variations around a fixed force level, delivered by muscles and other body structures)
- Duration of task
- Awkward postures for dental personnel
- Tasks requiring:
    - extended reach;
    - bent or twisted necks; or
    - abducted arms (drawing out to the side).

Control strategies to mitigate the risk associated with such ergonomic hazards include:

Engineering controls

- Good ergonomic design of workstation, chairs, instruments and equipment, for example, see Paragraph 4.31 of HBN 12 Supplement 2: Design implications of Oral Surgeries (National Health Service Estates) and ISO standards listed in the bibliography of ISO 4073:2009 (International Standards Organisation, 2009)
- Use of automatic and ultrasonic instruments / tools whenever possible
- Use of indirect vision when treating maxillary teeth
- Minimisation of glare through the use of appropriate lighting and window coverings

Administrative controls

- Adjustment of the workstation to the patient each time
- Scheduling of patients in an effort to reduce risk factors
- Training regarding ergonomic hazards and control strategies
- Early reporting system to capture symptoms of ergonomic concerns
- Alternating working posture frequently and performing stretches during any micro-breaks
- Including ergonomic considerations in all workstation/work equipment procurement policies
- Maintenance of all work equipment as per manufacturer's recommendations

2. Radiation (Ionising)

According to the former Radiological Protection Institute of Ireland (RPII 1996), the largest single contributor of man-made radiation exposure to the population is medical and dental diagnostic radiology. Dental radiology can give rise to a significant dose of radiation to the bone marrow in the skull and cervical spine, the oral mucosa, the thyroid and the eye.

The implications of regulation in this area for dental practices are:

- a licence must be obtained from the Environmental Protection Agency (formerly RPII);
- all radiological exposures shall be clinically justified (procedures that minimise the dose to patients and at the same time yield the required diagnostic information must be utilised);
- a named dentist in each practice referred to as the Radiation Protection Officer (RPO), who is appropriately trained (as approved by the Dental Council), is required to take on the day-to-

day responsibility for radiological protection;

- all x-ray units must be commissioned by an approved *Radiation Protection Advisor (RPA), prior to first being used on patients;
- all x-ray units shall be maintained and serviced by a suitably qualified and competent person (records must be kept);
- a Quality Assurance (QA) assessment must be carried out on all x-ray units by the appointed RPA every two years;
- it is essential that meticulous attention be given to processing techniques (in order that repeat x-ray examinations are not necessary);

- operators should stand at a distance of at least 2 metres from the patient's head during exposure and out of the direct line of the beam;
- special attention should be applied to the protection of women of childbearing age and pregnant women; and
- personal dosimetry is required unless a ^risk assessment performed by an *RPA in conjunction with the dentist indicates that operators are not expected to receive doses in excess of 1.0 mSv/year.

^The risk assessment carried out by the RPA shall estimate all expected staff doses, taking account of the following:

- identification of people at risk,
- realistic workload,
- type of X-ray unit,
- radiation output,
- types of scans performed,
- layout of surgery,
- operator position,
- the likelihood of recording a reportable dose, and
- previous dose records for the staff performing similar work.

*RPA Category 1 (for Dentistry) is defined as an advisor holding a degree or equivalent in a physical science, or a suitable combination of other qualifications and experience. In addition, training in a programme based on the topics of the basic syllabus is required. A category 1 RPA needs the equivalent of seven years' full-time experience in a post directly concerned with radiation protection practice. The EPA maintains a register of all approved RPAs on its website (www.epa.ie).

- Where handheld x-ray units are used, advice should be sought from the RPA regarding:
  - equipment selection,
  - review of current risk assessment and operation of 'dynamic risk assessments' for each use,
  - review of personal dosimetry arrangements, and
  - security arrangements against loss or theft.

A study conducted among Canadian dentists concluded that direct radiation injury has virtually been eliminated by improvements in radiologic equipment / methods and radioprotection measures (Gambhir, 2011).

Control strategies to mitigate the risk associated with such radiation hazards include:

Engineering controls

- Good workplace design:
  - room location and structural design (including shielding, screens, occupancy of adjoining rooms including above and below),
  - room size and positioning of equipment,
  - clearly defining the 2m control area from patient's head, and
  - radiation warning lights positioned at access doors, which illuminate during exposure.
- Good workplace equipment design:
  - certificates of conformity and CE-marking,
  - interlock systems,
  - minimal scatter,
  - correct positioning of devices, and
  - audible signal when exposure is ended.
- Replacement of older x-ray equipment with newer equipment (with additional safety features).

Administrative controls

- Radiation safety programme
- Staff training
- Procedures to reduce exposure time
- Exposure monitoring (where required)
- Periodic review by RPA, particularly if changes made
- Periodic test and examination of equipment
- Appropriately word "Radiation" warning signs posted on access doors
- Multilingual / Pictorial pregnancy signs in waiting or other appropriate areas

Protective equipment controls

- Lead aprons (for persons holding or supporting patients during a dental x-ray) and thyroid shields (for patients where the thyroid will be exposed)

3. Radiation (Non-Ionising)

Non-ionising radiation has become an important concern with the use of blue light and to cure various dental materials (for example composites and other resins) (Gambhir, 2011).

The Health and Safety Authority guidance document entitled *"Guidance for Employers on Control of Artificial Optical Radiation at Work Regulations 2010"* gives practical assistance for the prevention of occupational accidents and ill health associated with sources of artificial optical radiation. Medical treatments (for instance laser surgery and blue light therapy) are listed as work activities that generate hazardous levels of intense light in Annex B of the Guide.

Lasers:

The main clinical applications of lasers in dentistry are:

- Soft tissue and periodontal surgery
- Root canal treatment
- Desensitisation
- Analgesia
- Endodontics
- Tooth bleaching
- Tooth cavity preparation

The main occupational hazards associated with the use of lasers are:

- Eye damage
- Skin damage
- Fire
- Smoke inhalation (cellular and viral debris)

The main control strategies to mitigate the risk associated with exposure to laser beam hazards include:

Engineering controls

- Good workplace design:
  - ensure no reflective surfaces,
  - local exhaust ventilation,
  - fail-safe systems, and
  - lock/key access for activation.

Administrative controls

- laser safety programme,
- staff training, and
- restricted work area.

Protective equipment controls

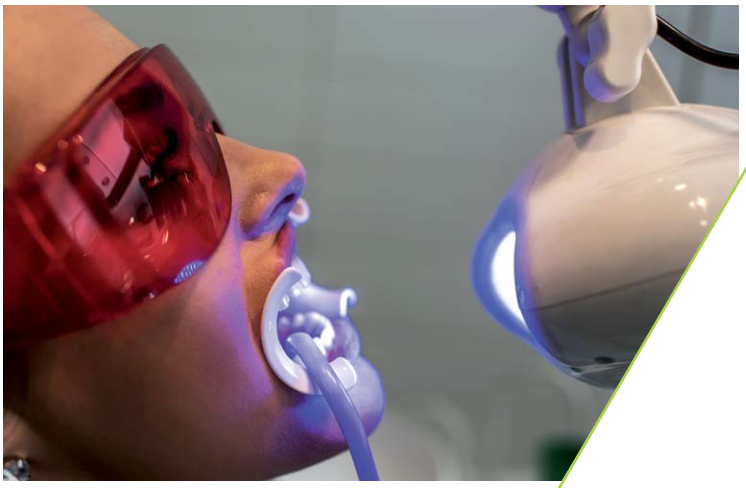
- gloves,
- gown, and
- appropriate eye-protection.

LED (Blue Light)

Curing light has become an integral part of the daily practice of restorative dentistry. In this regard, visible light-cured resin-based composites are the predominant restorative materials for both anterior and posterior restorations (Singh, 2011). Halogen lights and LED units are by far the most frequently used in daily practice.

From an occupational safety perspective, the blue light used to cure composite is not well tolerated by the human eye (i.e. solar retinitis).

Control strategies to mitigate the risks associated with exposure to LED (blue light) hazards include:



Engineering controls

- good workplace design (covering curing site), and
- blue light filters.

Administrative controls

- staff training,
- equipment maintenance as per manufacturer's guidelines, and
- restricted work area.

Protective equipment controls

- eye protection to light in the blue wavelength.

4. Pressure Equipment

Typical pressure equipment used in dentistry includes:

- compressed gas cylinders,
- autoclaves, and
- compressed air systems (fixed and portable).

The failure of pressure equipment can result in serious injuries to staff/patients and cause major damage to structure / property. The control measures to prevent such failures relate to the mechanical integrity of the equipment involved.

Compressed gas cylinders:

The main control strategies to mitigate the risks associated with compressed gas cylinder hazards include:

- store as per manufacturer / supplier recommendations (for instance upright, secured in place, well ventilated and appropriate area);
- ensure labelling is as per manufacturer's recommendations; and
- all staff involved in delivery, connection and disposal of cylinders must be trained and competent.

Autoclaves:

The most serious risks associated with autoclaves come from the uncontrolled release of stored energy (for example inadvertent opening or failure of door mechanism while under pressure). Others include:

- scalding, and
- explosion of sealed glass containers containing liquids.

Control measures to mitigate such risks include:

- determine the type of equipment (for example size, operating pressure, pressurising medium) and control system (manual or automated);
- assess the risk of door opening violently, under pressure;
- verifying "Nil" pressure before opening door;
- location;
- operator training and instruction;
- thorough examination of pressure equipment as per Schedule 12 Part B of the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016, at the following frequency:
    - 14 months for self-generating autoclaves; and
    - 26 months for all other autoclaves;
- maintenance and inspection (as per manufacturer's recommendations and undertaken by competent person).

Compressed air systems

The most serious risks associated with air receivers come from the uncontrolled release of stored energy (for example catastrophic failure of vessel whilst under pressure).

Control measures to mitigate such risks include:

- thorough examination of air receivers (every 26 months as per Schedule 12 Part B of the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016; and
- maintenance and inspection (as per manufacturer's recommendations and undertaken by competent person).

Chemical Agent Hazards

Dental medicaments and materials, as well as disinfectants used in dental surgeries, can cause allergies and skin diseases. Dentists are at risk of occupational exposure to a variety of chemicals such as anaesthetic gases, amalgam, acrylates, latex and disinfectants.

1. Anaesthetic Gases

In dentistry, a mixture of nitrous oxide (N_2O and oxygen (O_2) is used in inhalation analgesia for pain relief and anxiety reduction. The main sources of exposure to dental healthcare professionals are from:

- the patient's exhaled breath, and
- leaks in breathing circuits and face masks.

The main controls are:

- Scavenging system
- Room ventilation
- Maintenance of equipment
- Routine air monitoring

For more information, see the HSA information sheet "Controlling Waste Anaesthetic Gases in Healthcare Settings" September 2014, available at www.hsa.ie.

2. Amalgam

Most amalgams are now supplied in disposable capsules containing pre-measured amounts of mercury and other metal alloys, separated by a diaphragm.

All those involved with the handling of mercury in any form should understand its potential hazards and receive training in safe handling procedures to deal with mercury spills, including the safe disposal of contaminated materials.

The area where amalgam is prepared should be well ventilated and away from any form of heat (radiator, autoclave and sunlight, for example). The work surface should be smooth and impervious.

Waste dental amalgam is considered to be hazardous waste. The holder of the waste must have the amalgam waste collected and treated by a company licensed to handle this type of waste. Amalgam capsules, waste amalgam, amalgam sludge and used amalgam filters on suction units as well as extracted teeth with amalgam fillings must be segregated from other waste, stored in special UN-approved, labelled containers with vapour suppressant. Dispatch documentation for hazardous waste (including waste transfer forms, hazardous waste transport documents and tagging records) must be completed correctly and records kept by the waste generator.

3. Acrylate and its Compounds

Dental polymer materials based on Methacrylate, used as a filler, seem to be a major cause of contact dermatitis in dental personnel and also a cause of occupational asthma (Singh, 2011).

Control strategies to mitigate the risks associated with such exposures include:

Engineering controls

- where possible, substitution with less harmful product,
- maintain adequate general ventilation,
- enclosed mixing devices, and
- local exhaust ventilation.

Administrative controls

- develop safe work procedures,
- maintain good hygiene practices,
- staff training, and
- occupational health monitoring.

Protective equipment controls

- aseptic non-touch techniques (ANTT),
- gloves, eye-protection, and
- respirators, if risk assessment specifies.

4) Latex

According to (Singh, 2011), latex allergy was reported in 9% of dental personnel in a dental school in Australia. Latex gloves and masks have been worn routinely in the dental profession for more than two decades and are the basis of good infection prevention and control strategies.

Natural rubber latex (NRL) can cause asthma and dermatitis. Latex is used in medical gloves, but is also found in medical products (for example rubber dam equipment, elasticised bandages, dressings)

NHS plus Occupational Health Clinic Effectiveness Unit Report (Royal College of Physicians, 2008), concluded:

- using low-protein (hypoallergenic), powder-free gloves is unlikely to lead to new cases of latex allergy;
- individuals with existing latex allergy should continue to take latex-avoidance measures; and
- the health of individuals with existing latex allergy is not put at significant risk if colleagues use powder-free and hypoallergenic latex gloves.

For further information, see HSA guidance "Dermal Exposure Information Sheet 2010" and "The Prevention of Glove-related Latex Allergy in Healthcare Workers" at www.hsa.ie.

Biological Agent Hazards

Dentists may be exposed to a variety of micro-organisms via blood or oral / respiratory secretions.

Examples of such micro-organisms are:

- viruses, such as hepatitis B and C, Herpes Simplex virus types 1 and 2, HIV and cytomegalovirus; and
- bacteria, such as mycobacterium tuberculosis.

Possible sources of exposure to biological agents for dental healthcare professionals include:

- contact with contaminated sharps and healthcare waste;
- respiratory infectious disease through splatters from bodily fluids and/or projectiles while using high-speed rotary handpieces;
- respiratory infectious disease through airborne transmission; and
- environmental biological contaminants from water/ventilation systems (for example legionella).

According to the Dental Council of Ireland, 2015, exposure-prone procedures (EPPs) include situations where the worker's hands (whether gloved or not) may be in contact with sharp instruments, needle tips or sharp tissues (spicules of bone or teeth) inside a patient's open body cavity, wound or confined anatomical space where the hands or finger tips may not be completely visible at all times. There is an increased risk of transmitting blood-borne viruses between DHPs and patients during EPPs.

Standard precautions relating to infection prevention and control are based on the principle that all blood and body fluids, including secretions and excretions (except sweat), are potentially infectious. The objective of standard precautions is to break the chain of infection. Dental practices should have formal, written infection prevention and control policies, which are site-specific and are in line with standard precautions and national best practices.

The Dental Council Code of Practice relating to Infection Control, 2015, sets out the standards required to minimise the risk of infection to patients and dental healthcare professionals alike. The Dental Council requires dental healthcare professionals to adhere to this code of practice.

Control measures to reduce the risk of exposure include the following:

- Undertake a written risk assessment as per Regulation 7 of the Safety, Health and Welfare at Work (Biological Agents) Regulations 2013 and Regulation 4 of the EU (Prevention of Sharps Injuries in the Healthcare Sector) Regulations 2014 (Sharps Regulations)
- Provide training to all DHPs in infection prevention and control procedures. Training should equip staff to understand:
  - potential risks to health,
  - how infections are transmitted, and precautions to reduce exposure,
  - the practice policy on decontamination and infection prevention and control,
  - what personal protection is required and when to use it, and
  - what to do in the event of accidents or personal injury.
- Adherence to standard precautions by Dental healthcare professionals at all times in healthcare settings. The elements of standard precautions are:
  - occupational health programme (including immunisation and screening),
  - hand hygiene,
  - use of personal protective equipment (for example gloves, eye protection, face masks, gowns),
  - management of spills of blood and bodily fluids,
  - appropriate patient placement,
  - management of sharps,
  - management of needle-stick injuries,
  - safe injection practices,
  - respiratory hygiene and cough etiquette,
  - management of waste,
  - management of laundry,
  - decontamination of reusable medical equipment, and
  - decontamination of the environment.

Adherence to transmission-based precautions, in addition to standard precautions, may also be required in certain circumstances.

- Adherence to safe work practices and procedures in keeping with the requirements of the sharps regulations. Where there is a risk of a sharps injury, controls include:
  - the elimination of unnecessary use of sharps, in so far as it is reasonably practicable and where sharps cannot be eliminated,
  - the use of appropriate, safety-engineered protection mechanisms (i.e. the use of safer sharps) where they are available and appropriate,
  - prevention of re-capping needles,
  - procedures and arrangements for the safe use and disposal of used sharps,
  - the use of personal protective equipment (disposable gloves),
  - vaccination of employees,
  - information, training and awareness-raising with employees, and
  - reporting of incidents, response and follow up.

- Dental Unit Water Lines (DUWLs):
  - Dental Unit Water Lines (DUWLs) are prone to microbial contamination, build-up of biofilm and are a potential source of legionellosis (Dental Council of Ireland, 2015). Currently there is no microbial limit value set for dental unit output water in Ireland or the EU. The EU's potable drinking water standard of 100 cfu/ml should be adhered to as a minimum
  - The manufacturer's instructions should be followed for the periodic disinfection of water lines. Regular disinfecting with a chemical agent is the most effective approach.

- Management of waste:
  - for the purpose of infection prevention and control, waste from dental practices can be divided into two categories: clinical or healthcare risk waste and general office or non-risk waste. Dental practice waste is managed by segregating healthcare risk waste which is potentially infectious and hazardous from the bulk of waste which is domestic in nature;
  - healthcare risk waste includes blood, body tissue, items soiled in blood/saliva (for example patient cups, gloves, bibs, plastic saliva ejectors, used masks, rubber dams) and contaminated sharps;
  - all dental practice healthcare risk waste must be:
    - correctly segregated, and stored in the appropriate UN-approved containers (bags or bins depending on the nature of the waste), and
    - stored in a secure area with access limited to staff.

In addition:

- there must be arrangements in place to deal with spillages of waste;
- there must be supervision, training and information for employees on the correct procedures to be followed when handling dental practice waste;
- there must be an incident reporting and investigation procedure in place;
- the waste carrier removing and transporting the dental practice waste must have the appropriate waste collection licence/permit for the waste;
- dispatch documentation for clinical risk waste (including waste transfer forms, hazardous waste transport documents and tagging records) must be completed correctly and records kept by the waste generator; and
- there must be a carriage of dangerous goods contract with the specialised waste contractor to ensure legal duties under dangerous goods transport legislation are addressed.

Psychosocial Hazards

1. Work-related Stress

According to (Ayatollahi, 2012), 83% of dentists believe dentistry is "very stressful", with nearly 60% believing that dentistry is more stressful than other professions.

Some of the main sources of stress in dentistry include:

- Overcoming pain and fear
- Administration of anaesthesia
- Patient dissatisfaction with treatment
- Running behind schedule
- Work–life balance
- "Technostress"

Negative stress reactions include:

- Fatigue
- Anxiety
- Depression
- Physical illness

Some of the main types of mental health promotion interventions are:

- at organisational level – ensuring adequate staffing levels and skill mix, organising shift patterns, clearly specifying roles and responsibilities, internal communication, employee discretion and promoting worker participation;
- at organisation / individual interface level – improving relationships, establishing support groups, improving person-environment fit, increasing participation and autonomy, training (such as communication skills, coping mechanisms, self-compassion); and
- at individual level – interventions focused on reducing stress among those who already have symptoms (for example learning coping strategies, cognitive-behavioural training, stress management, counselling).

For further information, see HSA guide *"Work-related Stress, A Guide for Employers"* 2011 at www.hsa.ie.

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Notes

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