Radiation Protection

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Ionising Radiation is the subject of considerable safety legislation to minimise the risks to radiation workers and patients.

The International Commission on Radiological Protection (ICRP) regularly publishes data and general recommendations.
Three main considerations

- Justification
- Optimisation
- Limitation
Justification

- No practice shall be adopted unless its introduction produces a positive net benefit (actual or perceived)
All exposures shall be kept as low as reasonably practicable (ALARP), taking economic and social factors into account.
The dose equivalent to individuals shall not exceed the limits recommended by the ICRP.
Current UK Legislation

- Ionising Radiation Regulations – 1999 (SI 1999 No 3232) (IRR99)
  Replaces 1985 I.R.R. Regulations

- Ionising Radiation (Medical Exposure) Regulations – 2000
  Replaces the P.O.P.U.M.E.T. regulations of 1988
Guidelines on Radiological Standards in Primary Dental Care 1994

Published by N.R.P.B.
Cover all aspects of dental radiology
Set out principles of good practice
Guidelines cont....... 

- Selection Criteria for Dental Radiography
  *Published by Faculty of G.D.P. (U.K.)*
  *Frequency of radiographs*

- Guidance notes for Dental Practitioners on the Safe use of X-ray equipment.

*Dept. of health 2001*
Concerned mainly with safety of workers and public
Came into force in January 2000
Replace the ionising Radiation regulations on 1985
Essential legal Requirements 1

- Authorisation
- Notification
- Prior Risk Assessment
- Restriction of exposure
- Maintenance and examination of engineering controls
Essential legal Requirements 2

- Contingency Plans
- Local Rules
- Radiation Protection Adviser
- Information, instruction and training
- Designated areas
- Radiation protection Supervisor
Essential legal Requirements 3

- Classified persons
- Duties of manufacturers
- Duties of Employees
- X-ray equipment
  1. Intra-oral
  2. Panoramic
  3. Cephalometric
Authorisation

- Use of dental X-ray equipment for research purposes should be in accordance with a generic authorisation granted by the Health and Safety Executive
Prior Risk Assessment

- This must be undertaken before work commences and be subject to regular review
- All employees are recommended to record the findings of their risk assessment
Risk Assessment

1. Identify the Hazards
2. Decide who might be harmed and how
3. Evaluate the risks and see if further precautions are needed
4. Record the findings of the risk assessment
5. Review and revise if necessary
Restriction of exposure

- There is an over-riding requirement that radiation doses be restricted to staff and other persons to a level as low as reasonable practicable
- (ALARP)
Maintenance and Examination of Controls

- This applies to safety and warning features
Contingency Plans

- These should arise out of the risk assessment and be provided within the Local Rules
Local Rules

- Name of RPS and RPA & legal person
- Identification of controlled areas
- Summary of working instructions
- Contingency arrangements
- Details of dose investigation levels
- Arrangements for personal dosimetry
- Arrangements for pregnant staff
- Reminder of duties of employees
Radiation Protection Advisor

- Appointed in writing
- Suitably Trained
- Expert in Radiation Protection
- Able to advise on regulations and protection
Information, Instruction & training

- This must be provided for all persons
- It must be appropriate for their role
- It should be maintained
- It should be recorded
Designated Areas

- Controlled area around the X-ray set
- Within the primary beam
- Normally 1.5 m
- Only patient should be within this area
Radiation Protection Supervisor

- Usually a dentist or senior member of staff
- Should be appointed in compliance with IRR99
- Must be adequately trained
- Closely involved with Radiography
- Have authority to implement responsibilities.
Most dental staff are non classified
Annual dose limit 6mSv
Duties of Manufacturer

- The installer is responsible for the critical examination and report of all new or significantly modified equipment.
X–ray equipment

- All X–ray generating equipment and receptors should comply with the general requirements of the regulations.
Intra-oral Radiography 1

- Tube voltage 60–70 kV
  (no lower than 50 for old sets)
- Must operate within 10% of stated kV
- Beam diameter should not exceed 60mm
- Rectangular collimation on new equipment
- Beam size should not exceed 40 x 50 mm
- Total beam filtration should be 1.5 mm Al below 70 kV and 2.5 mm above 70kV
The focal spot should be marked on the tubehead
- FSD should be 100mm for $<60kV$
- FSD should be 200 mm for $>60kV$
- Film speed controls and exposure time setting should be provided
- E or F speed film should be used
Panoramic Radiography

- Equipment should have a range of 60–90kV
- Height of beam no more than 125mm
- Width of beam not > 5mm
- Must have adequate positioning aids
- New equipment should have field limiting facilities
Cephalometric Radiography.

- Equipment must be easily and correctly aligned
- Beam collimated to only cover diagnostic area
- Aluminium wedge to image soft tissues should be fitted at tubehead.
Must have light on control panel to indicate mains connection
Should have a light and audible signal that an exposure is being made
Timers must only work under continuous pressure and allow the operator to be outside the controlled area
Exposure times must be terminated automatically.
Duties of employees

- Must not knowingly expose themselves or others to unnecessary radiation
- Must exercise reasonable care when working with dental radiology
- Must immediately report any accident or over exposure to the *legal person*. 
Concern safety of patients
Came in to force on 13\textsuperscript{th} May 2000
Replace P.O.P.U.M.E.T. Regulations of 1988
Defines new positions of responsibility
Positions Defined

- Employer
- Referrer
- Practitioner
- Operator
Essential legal requirements

- Duties of the defined persons
- Radiation Protection File
- Optimisation
- Audit
- Expert Advice
- Equipment
- Training
The Employer

- A person or corporate body with natural or legal responsibility for a radiological installation. They are responsible for overall safety, radiation protection framework and ensuring that staff and procedures conform to regulations.
The Referrer

- A medical, dental or other health professional entitled to refer a patient to a practitioner for a medical exposure.
- They are responsible for supplying the practitioner with sufficient information to justify an appropriate exposure.
A Medical, Dental or other health professional entitled to take responsibility for a medical exposure

They must be adequately trained to take responsibility and decisions for medical exposures which they will justify on the grounds of:

1. Specific objectives of exposure
2. Total potential benefit to the patient
3. Anticipated detriment to the patient
4. Efficacy, benefits and risks of alternative techniques
The Operator

- A person conducting any practical aspect of a medical exposure, including exposing the radiograph and processing the film.
- They must be *adequately trained* for the role played in the exposure and processing.
All Personnel suitably trained in core subjects as appropriate.
All attended appropriate I.R.M.E. course every 5 years (5 hrs)
Record updated courses.
All staff who process radiographs to have suitable training.
Training

- The Practitioner should have an undergraduate degree conforming to the requirements of the curriculum as specified by the G.D.C..
- This includes the Core Curriculum in dental radiography as specified in the NRPB/RCR 1994 guidelines
1. Operators involved in radiographing patients

- Dentists – dental practitioner training
- Dental Nurses – Certificate in Dent. Rad. Conforming to syllabus of College of Radiographers.
- Dental Hygienists/Terapists as for nurses
Operators involved in processing / Q.A.

Dental Nurses and other D.C.P's should possess the Certificate in Dental Nursing or have received adequate training and documented training specific to the tasks that they undertake.
CPD is mandatory for all practitioners and operators involved in radiographing patients.

It is recommended that dental practitioners should attend formal courses equivalent to 5 hrs. verifiable C.P.D. every 5 years.

Operators should attend a continuing education course every 5 years.
Practitioner courses

These should cover:–

- Principles of radiation physics.
- Risks of Ionising Radiation
- Radiation doses in dental radiography
- Principles of Radiation protection
- Statutory Requirements
- Selection Criteria
- Quality Assurance
These should Cover:–

- Principles of radiation physics.
- Risks of Ionising Radiation
- Radiation doses in dental exposures
- Factors affecting Dose in radiography
- Principles of Radiation Protection
- Statutory Requirements
- Quality Assurance.
Lead Protection

- No justification for routine use
- Thyroid collar to be used for maxillary occlusal radiography
- Lead aprons do not protect against internal scatter
- If lead aprons are used they must be stored appropriately
Specifics for Women of childbearing age

- Check possibility of pregnancy
- Delay routine check ups.
- Justification doubly important
- Used lead protection for vertex occlusals
Dose limitation and annual dose limits

- Patients
- Radiation (classified) workers
- General Public
Patients

- There are 4 broad sub divisions of dose limits for patients
- examinations directly associated with illness, Periodic health checks
- Examination for occupational, medico legal and insurance purposes
- Examination for medical research
Radiation workers

- Classified
- Non-classified
Classified workers

- Receive high levels of radiation
- Require compulsory personal monitoring
- Require compulsory annual health checks
Non-classified Workers

- Low levels of exposure
- Annual dose limits 0.3 mSv for classified workers
- 1 mSv for operators
- 0.3 mSv for others
- Personal monitoring and annual health checks not required.
## Dose limits

<table>
<thead>
<tr>
<th>Classification</th>
<th>Old dose limits</th>
<th>New dose limits</th>
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<tbody>
<tr>
<td>Classified</td>
<td>50 mSv</td>
<td>20 mSv</td>
</tr>
<tr>
<td>Non-classified</td>
<td>15 mSv</td>
<td>6 mSv</td>
</tr>
<tr>
<td>Public</td>
<td>5 mSv</td>
<td>1 mSv</td>
</tr>
</tbody>
</table>
Methods of dose limitation

- Correct positioning of equipment
- Correct set up and use of equipment
- Correct maintenance of equipment
- Implementation of guidelines
- Implementation of controlled area
Selection Criteria

- No radiographic examination until a history and clinical examination has been taken.
- Radiographs as appropriate to determine level and status of dental health.
Frequency

Dependant upon

- Age
- Development
- Caries/medical risk
- Suspicion of pathology
- Monitoring progress of disease/healing