

# CERTIFICATE IN DENTAL RADIOGRAPHY

STEPHEN BRIGGS BDS BSC (HONS) RADIOGRAPHY

DAY 4

SAT 22<sup>ND</sup> NOVEMBER 2025

## TOPICS

- **RADIATION PROTECTION**
- **RADIOGRAPHIC ANATOMY**
- **RADIOGRAPHIC APPEARANCES OF COMMON DENTAL PATHOLOGY**

## RADIATION PROTECTION

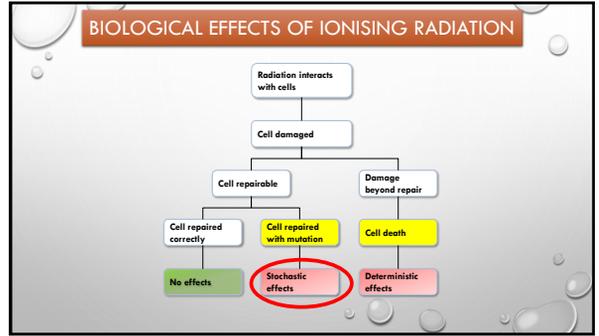
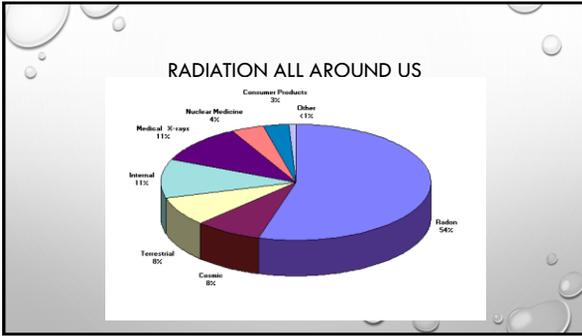
## AIM

- TO ENSURE DENTAL NURSES UNDERSTAND AND APPLY PRINCIPLES OF RADIATION SAFETY TO PROTECT PATIENTS, STAFF AND THEMSELVES DURING RADIOGRAPHIC PROCEDURES

## LEARNING OBJECTIVES

- DESCRIBE AND APPLY GENERAL RADIATION PROTECTION PRINCIPLES, INCLUDING IRCP AND ALARP
- SUMMARISE AND IMPLEMENT UK LEGISLATION (IRMER 18, IRR 17) AND LOCAL RULES IN PRACTICE
- CORRECTLY USE RADIATION PROTECTION DEVICES FOR PATIENTS AND STAFF, INCLUDING MONITORING DEVICES
- JUSTIFY EXPOSURES AND APPLY SELECTION CRITERIA FOR RADIOGRAPHS BASED ON FGDP GUIDELINES

- MANAGE INCIDENTS INCLUDING OVEREXPOSURE AND FOLLOW CORRECT REPORTING PROTOCOLS
- APPLY RADIATION PROTECTION MEASURES FOR PREGNANT WOMEN, INFANTS AND CHILDREN
- COMMUNICATE RISKS AND BENEFITS OF RADIOGRAPHY SAFELY TO PATIENTS



### BIOLOGICAL EFFECTS

- **DETERMINISTIC EFFECTS**
  - OCCUR AFTER A CERTAIN THRESHOLD OF RADIATION EXPOSURE
  - CUMULATIVE
- **STOCHASTIC EFFECTS**
  - CAN OCCUR AFTER ANY RADIATION EXPOSURE (EG. CANCER)
  - SOMATIC – ACUTE OR CHRONIC/LATENT
  - GENETIC



### DETERMINISTIC EFFECTS

- HAIR LOSS
- ERYTHEMA/DESQUAMATION
  - SKIN
- CATARACTS
- FIBROSIS
- HAEMOPOIETIC DAMAGE
  - RED BONE MARROW




### STOCHASTIC EFFECTS

- EFFECTS CAN APPEAR IN BOTH THE EXPOSED PERSON (SOMATIC) OR FUTURE GENERATIONS (GENETIC)

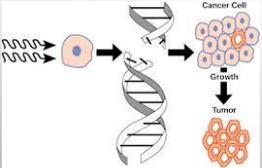
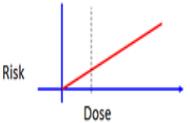



Figure 1. Development of cancer from mutation produced by ionising radiation.

### CELLS MOST AT RISK

- DAMAGE TO DNA CAN BE REPAIRED **GIVEN TIME**
- IF TIME IS NOT AVAILABLE, THE DNA WILL NOT BE HEALED
- RAPIDLY DIVIDING CELLS → NOT ENOUGH TIME FOR THE CELL TO REPAIR ITSELF BEFORE IT DIVIDES
- RAPIDLY DIVIDING CELLS ARE THEREFORE MOST AT RISK
- **CHILDREN ARE MOST VULNERABLE TO RADIATION EXPOSURE!**



### INCREASED RISK IN CHILDREN

- DUE TO THE INCREASED RISK OF **STOCHASTIC EFFECTS** IN CHILDREN:
  - IT IS IMPORTANT THAT DENTAL PROFESSIONALS ARE VIGILANT WITH X-RAY REQUESTS
  - X-RAYS FOR CHILDREN ARE GENERALLY PRESCRIBED **LESS FREQUENTLY** (EG. BITEWINGS)
  - PROFESSIONALS SHOULD BE CONFIDENT THAT A DIAGNOSTIC IMAGE IS **LIKELY** BEFORE MAKING EXPOSURES (EXPOSURES SHOULD NOT BE A 'SHOT IN THE DARK' HOPING THAT AN IMAGE WILL BE OK)

### WHAT'S THE RISK?

- LIFETIME CANCER RISK
  - HIGHER IN MEN
- UK RISK DUE TO DENTAL RADIOGRAPHS
  - MILLIONS OF DENTAL RADIOGRAPHS
  - VERY FEW ASSOCIATED MALIGNANCIES
- **CHILDREN 2-3 X MORE AT RISK THAN ADULTS!!**
  - CELLS DIVIDING MORE RAPIDLY
  - MUTATED CELLS LESS TIME TO REPAIR THEMSELVES



### ALARP

- **AS LOW AS REASONABLY PRACTICABLE**
  - THIS IS NOT AS LOW AS POSSIBLE!
  - IT MEANS THE LOWEST DOSE REQUIRED TO ACHIEVE A **DIAGNOSTIC X-RAY IMAGE**
  - THERE IS NO POINT USING A RADIATION EXPOSURE THAT DOES NOT PROVIDE A DIAGNOSTIC IMAGE TO ANSWER THE CLINICAL QUERY
  - THE DOSE OF RADIATION SHOULD ALWAYS BE DETERMINED BY HOW MUCH IS REQUIRED TO ANSWER THE QUESTION

### ICRP

- **INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION**
  - AN INDEPENDENT, INTERNATIONAL ORGANISATION THAT ADVANCES THE SCIENCE OF RADIOLOGICAL PROTECTION FOR THE PUBLIC BENEFIT, IN PARTICULAR BY PROVIDING RECOMMENDATIONS AND GUIDANCE ON ALL ASPECTS OF PROTECTION AGAINST IONISING RADIATION
  - A COMMUNITY OF ABOUT 350 GLOBALLY-RECOGNISED EXPERTS IN RADIOLOGICAL PROTECTION SCIENCE, POLICY AND PRACTICE FROM AROUND 40 COUNTRIES

### IONISING RADIATION REGULATIONS

- IONISING RADIATION REGULATIONS 17
  - **IRR17**
- IONISING RADIATION (MEDICAL EXPOSURE) REGULATIONS 2018
  - **IR(ME)R18**



### WHO DO THEY PROTECT?

- **IRR17**
  - STAFF
  - GENERAL PUBLIC
- **IR(ME)R18**
  - PATIENTS



**\*IRR 17**

- REGULATIONS THAT PROTECT **STAFF MEMBERS** AND THE **GENERAL PUBLIC** FROM IONISING RADIATION
- **LOCAL RULES** ARE REQUIRED BY THESE REGULATIONS
- ENFORCED BY **HSENI**

**"LOCAL RULES"**

- UNDER CURRENT HEALTH AND SAFETY LEGISLATION, THE DENTIST/TRUST AS AN EMPLOYER IS RESPONSIBLE FOR ENSURING THE SAFETY, HEALTH AND WELFARE AT WORK OF HIS OR HER EMPLOYEES AND OTHERS WHO MAY BE AFFECTED BY HIS OR HER WORK ACTIVITIES
- INDIVIDUAL WORKERS ALSO HAVE CERTAIN RESPONSIBILITIES AND THESE ARE INCLUDED IN THE **LOCAL RULES**
- **RADIATION PROTECTION SUPERVISOR (RPS)**
  - ENSURES COMPLIANCE OF STAFF WITH THESE RULES

**(1) RESTRICTION OF EXPOSURE / PERSONNEL MONITORING**

- DOSIMETERS
- TRUNK / CHEST / WAIST
- WARNING LIGHTS / NOTICES
- LOCKS / EMERGENCY OFF
- CLEARLY MARKED CONTROLS
- EXPOSURE SWITCHES REQUIRE CONTINUOUS PRESSURE
- PPE

- (2) **Employee Investigation Level**
  - If exceeded.....RPS investigation

**DOSIMETERS**

- TRUNK (CHEST OR WAIST) LEVEL
- UNDER PROTECTIVE CLOTHING
- CHANGE AT APPROPRIATE TIME
  - NO LONGER THAN 3 MONTH PERIOD
  - RETURNED BY THE RPS
  - APPROVED DOSIMETRY SERVICE (ADS)
- DO NOT
  - LEAVE IN CONTROLLED AREA
  - LEAVE IN EXTREMES OF HEAT/HUMIDITY
  - GET WET
  - WEAR WHEN SUBJECT TO OWN MEDICAL EXPOSURE



**DOSIMETRY**

- RADIATION DOSE IS MEASURED TO BOTH THE PATIENT AND STAFF
- THIS CAN BE DONE USING DOSIMETERS THAT ARE WORN BY THE STAFF
- RADIATION DOSES TO PATIENTS ARE DISPLAYED ON MOST EXTRAORAL UNITS
- INTRAORAL DOSES ARE MOSTLY CALCULATED USING THE EXPOSURE FACTORS USED

DOSIMETERS CAN LOOK LIKE THIS AND BE WORN BY **INDIVIDUAL STAFF** ON THEIR UNIFORMS

(THIS ONE IS JUST A CONTROL ONE)



THESE SHOULD BE CLIPPED ONTO UNIFORMS AND **FACING FORWARDS** AT ALL TIMES (NOT ON LANYARDS ETC)

## DOSIMETERS

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  - APPROVED DOSIMETRY SERVICE (ADS)
- **DO NOT**
  - LEAVE IN CONTROLLED AREA
  - LEAVE IN EXTREMES OF HEAT/HUMIDITY
  - GET WET
  - WEAR WHEN SUBJECT TO OWN MEDICAL EXPOSURE

OR THEY CAN BE USED TO RECORD THE RADIATION DOSE THAT STAFF MAY BE EXPOSED TO AT A **CONTROL PANEL**

(STUCK BESIDE THE CONTROL PANEL)



- DAMAGED OR LOST DOSIMETERS SHOULD BE REPORTED TO RPS AND REPLACED IMMEDIATELY
- INADVERTENT IRRADIATION – REPORT TO RPS
- UNFORESEEN EXPOSURE OF ANYONE – RPS
- RECORDS KEPT FOR 2 YEARS
  - AVAILABLE FOR INSPECTION
  - REGULARLY REVIEWED BY RPS
  - ENSURES DOSE INVESTIGATION LEVEL NOT LIKELY TO BE EXCEEDED

Radiation  
Controlled  
Area

### (3) CONTROLLED AREAS / RESTRICTION OF ACCESS

- ONLY REMAIN IN CONTROLLED AREA IF PRESENCE REQUIRED FOR PROCEDURE OR TRAINING PURPOSES
- MUST USE PROTECTIVE CLOTHING/SCREENS
- ANY DIRECTION WITHIN **1.5M** OF THE TUBE HEAD



"We just got a new x-ray machine. Hold still. We're almost in range. I mean, position."

### (4) SYSTEMS OF WORK

- DOSE INVESTIGATION LEVEL
- PERSONAL DOSIMETERS ACCORDING TO GUIDELINES
- REQUIREMENT TO PUT PROCEDURES IN PLACE TO ESTIMATE DOSES TO MEMBERS OF THE PUBLIC

**GENERAL**

- STAFF SHOULD NOT EXPOSE THEMSELVES OR OTHERS MORE THAN NECESSARY FOR WORK PURPOSES
- PROTECTIVE EQUIPMENT AND DOSIMETERS (ALWAYS)
- EXPOSURE FACTORS SHOULD BE MINIMISED TO REDUCE PATIENT RADIATION DOSE (ALARP)
- REMAIN OUTSIDE CONTROLLED AREAS UNTIL WARNING LIGHT OUT
- CAN **ONLY** EXPOSE IF ENTITLED/TRAINED TO DO SO
- TRAINEES MUST BE SUPERVISED BY SENIOR STAFF
- SENIOR STAFF MUST ENSURE LOCAL RULES ARE FOLLOWED
- ALL STAFF SHOULD KNOW EMPLOYERS PROCEDURES (IRMER)

- X-RAY EQUIPMENT MUST NOT BE DELIBERATELY MISUSED OR TAMPERED WITH
- DO NOT DIRECT BEAM AT DOORS OR PROTECTIVE SCREENS
- ALL STAFF SHOULD BE AWARE OF “**EMERGENCY OFF**” AND MAINS ISOLATION SWITCHES
- TURN OFF ALL X-RAY EQUIPMENT AT END OF DAY
- FAULTS REPORTED IMMEDIATELY TO RPS
  - CAN LEAD TO ADDITIONAL RADIATION EXPOSURE
    - EXPOSURE FAILS TO TERMINATE
    - EMERGENCY STOP ACTIVATED
    - OTHER PARAMETERS FALL OUTSIDE LIMITS

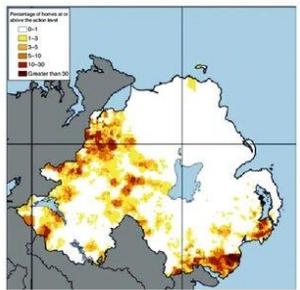
**STAFF PREGNANCY**

- STAFF WHO BECOME PREGNANT SHOULD INFORM EMPLOYER VIA RPS IN **WRITING ASAP**
- RISK TO THE FOETUS ASSESSED/DUTIES ADJUSTED
- **CANNOT** SUPPORT PATIENTS



**BACKGROUND RADIATION**

- **AVERAGE ANNUAL DOSE IN NI = 2.5MSV (ADULTS)**
  - 1-8 MSV DEPENDING ON WHERE YOU LIVE
  - RADON NOT THOUGHT TO AFFECT BABY, SO WHEN EXCLUDED FROM BACKGROUND RADIATION = 1-3 MSV/YEAR
- THEREFORE, **MOVING HOUSE COULD RESULT IN A LARGER INCREASE IN FOETAL RADIATION DOSE THAN MOST OCCUPATIONAL DOSES!!!**



**EXPOSURE OF FEMALE PATIENTS OF REPRODUCTIVE CAPACITY | PREGNANT PATIENTS**

- INTRAORAL, PANORAL OR CEPHALOMETRIC EXAMINATIONS CAN BE CARRIED OUT **WITHOUT** ENQUIRY INTO PREGNANCY
- THIS IS BECAUSE THE PRIMARY BEAM IS **NOT** BEING AIMED AT THE DEVELOPING FOETUS

### CONTINGENCY PLANS

- REASONABLY FORESEEABLE ACCIDENTS, OCCURRENCES OR INCIDENTS INVOLVING THE RADIATION SOURCES
  - FAILURE OF AN X-RAY UNIT TO TERMINATE EXPOSURE
  - UNINTENTIONAL DOSE OF IONISING RADIATION
- IF FAULT SUSPECTED
  - ISOLATE X-RAY UNIT FROM THE MAINS SUPPLY VIA EMERGENCY OFF BUTTON
  - DO NOT USE AGAIN UNTIL UNIT INVESTIGATED AND SERVICED
  - NOTICE SHOULD BE PLACED ON UNIT TO INFORM STAFF

Significant event –  
needs to be  
reported to HSE

### ACCIDENTAL OVEREXPOSURE

- REPORT IMMEDIATELY TO RPS/LINE MANAGER
  - INITIAL INVESTIGATION
- DETAILS OF INCIDENT RECORDED
- RPS WILL LIAISE WITH RPA AND EMPLOYER (IF NOT CLEAR)
  - DETAILED INVESTIGATION

### CHECKS OF PROTECTIVE APRONS

- EACH APRON MUST BE UNIQUELY IDENTIFIED
- EXAMINED VISUALLY **AT LEAST ONCE PER YEAR** TO ENSURE THAT THEY REMAIN UNDAMAGED
- **DO NOT FOLD APRONS!!!**
  - STORE FLAT OR HUNG OVER A RAIL

### CHANGES TO BUILDINGS, EQUIPMENT OR PROCEDURES

- RPA MUST BE INFORMED
  - REVIEW RISK ASSESSMENT
  - REVIEW ADEQUACY OF PERSON PROTECTION
  - REVIEW DESIGNATION OF WORK AREAS
  - CRITICAL EXAMINATION OF NEW INSTALLATIONS

### RECORDS

- RADIATION RISK ASSESSMENTS
- EQUIPMENT
  - INVENTORY
  - CRITICAL EXAMINATIONS
  - MAINTENANCE/MODIFICATION AND FAULT LOG
  - QA
- MEDICAL PHYSICS WORK AND ACTIONS TAKEN
  - RADIATION PROTECTION SURVEYS
  - EQUIPMENT PERFORMANCE SURVEYS
  - PATIENT DOSIMETRY SURVEYS

### OPERATING RULES

- **OPERATOR POSITION**
  - OUTSIDE DENTAL SURGERY
  - BEHIND WALLS/PROTECTIVE PANEL
  - AS FAR FROM X-RAY TUBE AS POSSIBLE
- **WARNING LIGHTS**
  - UNDER OBSERVATION AT ALL TIMES
- **BEAM DIRECTION**
  - NEVER POINTED AT DOORS, WINDOWS OR OPERATOR POSITION

### RPS DUTIES

- ENSURE WORK IN ACCORDANCE WITH LOCAL RULES
- LIAISON WITH CLINICAL LEAD AND RPA
- CRITICAL EXAMINATION OF EQUIPMENT BEFORE USE
- ENSURE TESTS OF ENGINEERING CONTROLS, DESIGN FEATURES, SAFETY FEATURES AND WARNING DEVICES ARE CARRIED OUT AT SUITABLE INTERVALS
- NOTIFY RPA IF CHANGES TO EQUIPMENT, ROOM LAYOUT OR TECHNIQUE THAT MAY AFFECT RADIATION PROTECTION

- CONSULT WITH RPA ON RADIATION SAFETY MATTERS
- ADEQUATE STAFF TRAINING
  - ESPECIALLY BEFORE NEW EQUIPMENT/PROCEDURES
- KEEP UP-TO-DATE RECORDS
  - PPE EXAMINATION / SUPPORTING PATIENTS / PREGNANCY NOTIFICATION
- SUPERVISE DOSIMETER USAGE
- REPORT OVEREXPOSURE INCIDENTS
  - LINE MANAGER AND RPA
- REVIEW LOCAL RULES

### RPA DUTIES

- A SUITABLY TRAINED RPA MUST BE APPOINTED IN WRITING AND CONSULTED FOR ADVICE UNDER IRR 99/2000
- SHOULD BE AN **EXPERT** IN RADIATION PROTECTION
- ADVICE FOR COMPLIANCE WITH THE REGULATIONS
  - CONTROLLED AREAS
  - INSTALLATION OF NEW OR MODIFIED EQUIPMENT
  - PERIODIC EXAMINATION AND TESTING OF ENGINEERING CONTROLS, SAFETY FEATURES AND WARNING SIGNALS
  - SYSTEMS OF WORK
  - RISK ASSESSMENT
  - CONTINGENCY PLANS
  - STAFF TRAINING
  - ASSESSMENT AND RECORDING OF DOSES RECEIVED BY PATIENTS

### SIGNIFICANT EVENTS

- SIGNIFICANT EVENTS MUST BE RECORDED AND ANALYSED
- ADVICE OF THE RPA SHOULD BE INVOLVED
- ALSO RECORD NEAR MISSES
- IN ACCORDANCE WITH IRR17
  - **SIGNIFICANT EVENT IS ONE THAT TRIGGERS A CONTINGENCY PLAN**  
(EG) HAVING TO HIT THE EMERGENCY STOP DURING AN EXPOSURE

### IR(ME)R 2018

- REGULATIONS THAT PROTECT PATIENTS FROM IONISING RADIATION
- **EMPLOYERS PROCEDURES** (FOR THE UNDERTAKING OF MEDICAL DENTAL X-RAY EXPOSURES) ARE REQUIRED BY THESE REGULATIONS
- REGULATED BY **RQIA** IN NORTHERN IRELAND

### IR(ME)R 2018

- 4 DUTY HOLDERS
  - **EMPLOYER**
  - **REFERRER**
  - **PRACTITIONER**
  - **OPERATOR**

- (1) **EMPLOYER**
  - CARRIES OUT OR ENGAGES OTHERS TO CARRY OUT MEDICAL EXPOSURES OR PRACTICAL ASPECTS AT A GIVEN INSTALLATION
  - SETS WRITTEN PROCEDURES/RULES FOR OTHER STAFF TO FOLLOW
- (2) **REFERRER**
  - REFERS THE PATIENT
  - MUST SUPPLY SUFFICIENT MEDICAL INFORMATION FOR PRACTITIONER TO JUSTIFY EXPOSURE

- (3) **PRACTITIONER**
  - JUSTIFIES THE IONISING RADIATION EXPOSURE
  - BENEFIT VS RISK ASSESSMENT
- (4) **OPERATOR**
  - CARRIES OUT PRACTICAL ASPECTS OF EXPOSURE
  - PRESSING BUTTON, COLLIMATING BEAM, IDENTIFYING PATIENT, QA MEASUREMENTS
  - ENTITLEMENT FORMS MAY BE REQUIRED

### ENTITLEMENT

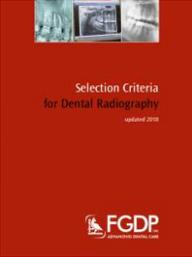
Registrant Group	IR(ME)R Duty Holder	Qualifications/Training/Experience required
Dentist	Referrer	Registration with GDC with additional training if requesting CBCT
	Practitioner	Registration with GDC and undergraduate dental degree
	Operator	Undergraduate dental degree and local equipment training
Dental Nurse	Operator	Diploma or certificate in Dental Nursing (include radiography if taking radiographs) and local equipment training
Dental Hygienist/Therapist	Referrer	Registration with GDC and appropriate qualification e.g. Diploma in Dental Hygiene and Dental Therapy with additional skills development
	Operator	Appropriate qualification and local equipment training

### ENTITLEMENT FORM

Operator tasks at XXXXX Practice	Assigned as competent
Competent to carry out patient identification	Date & signature/initials of duty holder and assessor
Competent to authorise all dental exposures for which guidelines have been provided by a practitioner	
Competent to undertake all dental examinations	
Competent to undertake intra oral examinations	
Competent to undertake GPO / Lat Tough examinations	
Competent to undertake cone beam CT dental examinations	
Competent to produce dental films	
Competent to change chemicals in a dental laboratory	
Competent to process CP plates	
Competent to produce digital images	
Competent to clinically evaluate all dental examinations undertaken at the practice	
Competent to clinically evaluate all dental examinations undertaken outside the practice	
Competent to clinically evaluate cone beam CT dental examinations	
Competent to carry out quality assurance on equipment	

ASSESSOR CAN BE ANOTHER EXPERIENCED DCP

### SELECTION CRITERIA



- SELECTION CRITERIA FOR DENTAL RADIOGRAPHY IS THE LEADING GUIDELINE ON INDICATIONS FOR RADIOGRAPHIC INVESTIGATION, COVERING TREATMENT PLANNING AND MONITORING, IONISING RADIATION REGULATIONS AND BEST PRACTICE

- BASED ON A COMPREHENSIVE REVIEW OF ALL OF THE AVAILABLE DATA AND GUIDANCE, AND WIDE CONSULTATION WITH RELEVANT PROFESSIONAL BODIES AND SPECIALIST GROUPS TO PROVIDE CONSENSUS ON BEST PRACTICE, IT GIVES CLEAR, SIMPLE AND PRACTICAL ADVICE ON THE SAFE AND EFFECTIVE USE OF RADIOGRAPHY IN PRACTICE
- IT COVERS THE USE OF RADIOGRAPHS FOR THE DEVELOPING DENTITION, ENDODONTIC ASSESSMENT, CARIES DIAGNOSIS, PERIODONTAL ASSESSMENT, AND IMPLANTOLOGY, AND HAS BEEN UPDATED IN 2018 TO INCLUDE DIGITAL RADIOGRAPHY AND CBCT, AS WELL AS TO INCLUDE EXPANDED GUIDANCE ON THE USE OF RADIOGRAPHY IN IMPLANTOLOGY, AND ADDITIONAL GUIDANCE ON PAEDIATRIC RADIOGRAPHY

### EXAMPLES OF INDICATIONS

- IOPA – PERIAPICAL PATHOLOGY, ROOT FRACTURE, ENDODONTICS, PERIODONTAL DISEASE
- BITEWINGS – CARIES, PERIODONTAL DISEASE (MILD), EXISTING RESTORATIONS
- OPT – TMJ PROBLEMS, ORTHODONTIC ASSESSMENT, WISDOM TEETH, PERIODONTAL ASSESSMENT, IMPLANT ASSESSMENT
- CEPH – ORTHODONTICS, ORTHOGNATHIC SURGERY

### RQIA IR(ME)R INSPECTIONS

- APPROX. NUMBER OF FILMS TAKEN PER YEAR
- PROTOCOLS FOR ALL PROCEDURES (SIGNED, DATED AND REVIEW DATE)
- EXPOSURE CHART FOR EACH UNIT (SIGNED AND DATED)
- RECORDS OF CPD TRAINING – DENTISTS AND DCPS
- INVENTORY OF EQUIPMENT – MAKE, MODEL, SERIAL NUMBER, YEAR OF MANUFACTURE, YEAR OF INSTALLATION
- COMPETENCY CHECKS FOR TRAINING IN IRMER ROLES – DENTISTS AND DCPS
- ENTITLEMENT FORMS – ALL DUTY HOLDERS
- EVIDENCE OF QA PROGRAMME/IMAGE QUALITY AUDIT
- COPIES OF EMPLOYER'S PROCEDURES
- RADIATION PROTECTION POLICY

### JUSTIFICATION

- EVERY EXPOSURE MUST BE:
  - **JUSTIFIED BY THE PRACTITIONER**
  - **AUTHORISED BY THE PRACTITIONER** (PHYSICAL RECORDING THAT THE EXPOSURE IS JUSTIFIED – USUALLY SIGNED)
- RESEARCH EXPOSURES MUST BE APPROVED BY AN NHS RESEARCH ETHICS COMMITTEE
- MEDICO-LEGAL EXPOSURES MUST COMPLY WITH THE EMPLOYERS PROCEDURES

### JUSTIFICATION

- NET BENEFIT TO THE PATIENT
- **BENEFIT MUST OUTWEIGH THE RISK**
- SELECTION OF RADIOGRAPHS MUST BE BASED ON EACH **INDIVIDUAL PATIENT'S HISTORY AND CLINICAL EXAMINATION**
- ROUTINE USE OF X-RAYS FOR DIAGNOSIS BASED ON A GENERAL APPROACH RATHER THAN INDIVIDUAL PRESCRIPTION IS **UNACCEPTABLE**
- A ROUTINE (OR 'SCREENING') EXAMINATION IS ONE THAT IS TAKEN REGARDLESS OF THE PRESENCE OR ABSENCE OF CLINICAL SIGNS AND SYMPTOMS
  - 'GENERAL OVERVIEW' TO CHECK FOR PATHOLOGY – THIS SHOULD NOT HAPPEN
  - RADIOGRAPHS SHOULD BE TAILORED TO EACH PATIENT

### DOSE OPTIMISATION

- DOSES KEPT **ALARP** (AS LOW AS REASONABLY PRACTICABLE)
- RESPONSIBILITY OF OPERATOR AND PRACTITIONER
- **COLLIMATOR SHOULD ALWAYS BE USED WHERE POSSIBLE**
- OPERATOR TO PAY SPECIAL ATTENTION TO QA, PATIENT DOSE AND DRL'S SET OUT IN EMPLOYERS PROCEDURES
- RESEARCH – VOLUNTARY, INFORMED OF ASSOCIATED RISKS, DOSE CONSTRAINTS ADHERED TO

### "EMPLOYERS PROCEDURES"

- **ACCEPTING A REFERRAL FOR DENTAL EXPOSURE**
  - REFERRING TO YOURSELF
- **IDENTIFYING PATIENTS CORRECTLY**
  - OPERATOR IS RESPONSIBLE
  - IF PATIENT CANNOT IDENTIFY THEMSELVES, ASK RELATIVE, NURSE OR CARER

- **IDENTIFICATION OF IR(ME)R ROLES**

- **REFERRER** = REGISTERED DENTAL PRACTITIONER
- **PRACTITIONER** = REGISTERED DENTAL PRACTITIONER
- **OPERATOR** = REGISTERED DENTAL PRACTITIONER, HYGIENIST, THERAPIST, TRAINED DENTAL NURSE. SUITABLY TRAINED MEDICAL TECHNICAL OFFICER OR CLINICAL SCIENTIST (PURPOSES OF QA MEASUREMENTS)

- **MEDICO-LEGAL / 3<sup>RD</sup> PARTY EXPOSURE**

- EXPOSURE WHERE PRIMARY BENEFIT IS **NOT** FOR HEALTH REASONS
- WRITTEN PROTOCOLS
- DIAGNOSTIC REFERENCE LEVELS (DRL)
- OPTIMISATION

- **FEMALES OF CHILD-BEARING AGE**

- NOT ROUTINELY ASKED IN DENTAL.....NOT DIRECTED AT PELVIS
- EXPOSURE JUSTIFIED? YES.....CAN PROCEED WITH CONSENT, NO.....DELAY
- EXPLAIN RISK/DOSE TO FOETUS IS NEGLIGIBLE
- CAN USE LEAD APRON IF PATIENT WISHES (REASSURANCE)

- **ENSURING QA PROGRAMMES ARE FOLLOWED**

- **BOTH WRITTEN PROTOCOLS AND EQUIPMENT**
- EMPLOYERS PROCEDURES, DRL'S AND WRITTEN PROTOCOLS FOR DENTAL X-RAY EXAMINATIONS (REVIEWED ANNUALLY)
- **EQUIPMENT QA** IMPORTANT TO ENSURE OPTIMAL DOSES ARE BEING GIVEN TO PATIENTS

- **ASSESSMENT OF PATIENT DOSE**

- OPERATORS SHOULD SET EXPOSURE FACTORS ACCORDING TO STANDARD EXPOSURE CHARTS BESIDE X-RAY EQUIPMENT

- **USE OF DIAGNOSTIC REFERENCE LEVELS (DRL)**

- PROPOSED BY THE NRPB FOR INTRA-ORALS / PANORALS
- IF OVER THESE LEVELS:
  - RPS – THOROUGH REVIEW OF RADIOGRAPHIC PROCEDURES
  - RPA – IMPROVE CURRENT TECHNIQUES, JUSTIFY CONTINUAL USE

- **RESEARCH (BIOMEDICAL OR MEDICAL)**

- SPECIAL CONSIDERATION FOR RESEARCH EXPOSURES
- **RPA (RADIATION PROTECTION ADVISOR) MUST BE CONSULTED BEFOREHAND**

- **BENEFIT AND RISK INFORMATION**

- GIVEN TO PATIENTS BEFORE EXPOSURE
- POSTERS

- **RECORDING OF CLINICAL EVALUATION OF EACH DENTAL X-RAY EXAMINATION**

- REFERRER IS RESPONSIBLE
- REQUIRES DENTIST SIGNATURE (AND OPERATOR IF DIFFERENT)

- **EXPOSURES MUCH GREATER THAN INTENDED**

- OPERATOR MUST NOTIFY EMPLOYER
- EMPLOYER INVESTIGATION WITH RPA ADVICE
- STEPS TO PREVENT REOCCURRENCE

- **ENSURING THAT THE PROBABILITY AND MAGNITUDE OF ACCIDENTAL OR UNINTENDED EXPOSURES ARE MINIMISED**

- ID CHECKED
- OPERATORS ARE PROPERLY TRAINED
- EQUIPMENT ISOLATED FROM MAINS WHEN NOT IN USE
- EQUIPMENT MAINTENANCE (CHECKED BEFORE RE-USE)
- QA PROGRAMMES IN LINE
- OPERATORS ADHERE TO WRITTEN PROTOCOLS FOR EXAMINATIONS USING EACH PIECE OF EQUIPMENT

### • RADIATION INCIDENT REPORTING

- RPS INFORMED IF ANY INCIDENT WHERE UNINTENDED OR ACCIDENTAL EXPOSURE

### • CLINICALLY SIGNIFICANT UNINTENDED OR ACCIDENTAL EXPOSURE

- PATIENT NEEDS TO BE INFORMED IF DEEMED SIGNIFICANT
- SPEAK TO MEDICAL PHYSICS EXPERT

### • CARERS AND COMFORTERS

- KNOWINGLY AND WILLINGLY INCUR RADIATION EXPOSURE WHILE HELPING OR SUPPORTING OTHERS
- INDIVIDUALLY JUSTIFIED AS PART OF JUSTIFICATION PROCESS
- DOSE CONSTRAINTS AND GUIDANCE REQUIRED FOR CARERS AND COMFORTERS

### • EQUIPMENT QA

- ADEQUATE TESTING
  - BEFORE USE
  - REGULAR INTERVALS
  - AFTER MAJOR MAINTENANCE
- IMPLEMENT MEASURES TO IMPROVE INADEQUATE OR DEFECTIVE EQUIPMENT

### • PATIENT DOSE AND RISK INFORMATION

- ENFORCING AUTHORITY SHOULD PROVIDE A REPORT RELEVANT TO RADIATION PROTECTION IN RESPECT OF MEDICAL EXPOSURES
- LESSONS LEARNED FROM SIGNIFICANT EVENTS AND ACCIDENTAL/UNINTENDED EXPOSURES
- (EG) IRMER ANNUAL REPORT FROM THE CQC OR RQIA

### • MEDICAL PHYSICS EXPERT (MPE)

- APPOINTED AND INVOLVED IN EXPOSURES
- MUST BE REGISTERED AND MEET COMPETENCE CRITERIA
- MUST BE INVOLVED IN....
  - INDIVIDUAL RADIATION PROTECTION MATTERS
  - ADVICE ON REGULATION COMPLIANCE
  - EQUIPMENT PERFORMANCE AND QA
  - OPTIMISATION
  - ANALYSIS OF ACCIDENTAL/UNINTENDED EXPOSURES

### • AUDIT

- IRMER AUDITS NEED TO BE CARRIED OUT REGULARLY FOR PATIENT PROTECTION
- SPECIFY AUDITS CARRIED OUT IN PRACTICE

## Equipment QA and IRMER

### QUALITY AND SAFETY CHECKS ON EQUIPMENT

- CO-ORDINATED BY RESPONSIBLE PERSON (PROBABLY RPS OF DEPARTMENT/PRACTICE)
- RADIATION SAFETY ASSESSMENT (RADIATION SURVEY) OF EQUIPMENT AT INTERVALS **NOT MORE THAN 3 YEARS**

### FILM PROCESSING

- APPROPRIATE TESTS IN THE QA PROGRAMME SHOULD BE CARRIED OUT AT RECOMMENDED INTERVAL
- MANUFACTURERS INSTRUCTIONS
- FULLY DOCUMENTED
- ENSURES ADEQUATE IMAGE QUALITY

### PATIENT DOSE RECORDING

- WHERE AVAILABLE, THE PATIENT DOSE SHOULD BE RECORDED
  - WILL USUALLY BE AVAILABLE ON EXTRAORAL - OPT, CEPH, CBCT (EG. MGYSM2)
- FOR MOST PATIENTS, THE AVERAGE EXPOSURE FACTORS USED WILL BE TAKEN OFF THE EXPOSURE CHART (KV, MA, SECS)
- WHEN MODIFIED FROM AVERAGE EXPOSURE, THE EXPOSURE FACTORS SHOULD BE RECORDED TO INDICATE A DIFFERENT EXPOSURE WAS USED
- MEDICAL PHYSICS CAN USE THESE FIGURES TO CALCULATE A PATIENT DOSE IF REQUIRED

### DOSE OPTIMISATION

- CHOOSE CORRECT EXPOSURE FACTORS
  - USE CHART
- USE COLLIMATOR AS GOLD STANDARD
  - ALWAYS WHEN USING HOLDERS
- TAKE AS FEW IMAGES AS POSSIBLE
- ALWAYS OPT FOR IMAGING EXAMINATION THAT HAS LOWEST DOSE TO PATIENT
- WEIGH UP QUERY WITH DOSE REQUIRED TO ANSWER IT

### EFFECTIVELY COMMUNICATING RADIATION RISKS TO PATIENTS

- ▶ NEGLIGIBLE RISK
- ▶ SMALLEST RADIATION EXPOSURE OF ALL X-RAY EXAMINATIONS
- ▶ **BENEFITS VS RISK (JUSTIFICATION)**
  - ▶ **BENEFIT = DIAGNOSIS CAN BE DETERMINED / CONFIRMED**
  - ▶ **RISK = VERY SMALL RADIATION DOSE**
- ▶ 1 IOPA = EQUIVALENT OF A FEW DAYS BACKGROUND RADIATION (DEPENDING ON WHERE YOU LIVE)

**Dental X-rays**

**Your health**  
 Dental X-rays help with making a diagnosis, planning treatment or monitoring the health of your teeth. They involve the use of ionising radiation (X-rays) to produce detailed images of teeth, gums and jaws.

**Radiation**  
 Everyone receives ionising radiation every day from radioactivity in the air, food we eat and even from space. The amount of radiation used for dental X-rays is similar to your everyday exposure over a few days, so the risks associated with them are very low for both adults and children.

**Our staff and equipment**  
 Staff are trained to take the best possible images using the lowest amount of radiation. Equipment is regularly checked to make sure the test is safe and effective.

**Your test**  
 You may have your X-ray taken during your dental examination or you may need to go to an X-ray room, depending on the type of exam required to get the appropriate information. You will normally be informed of the outcome of the X-ray before you leave. If not, our staff will tell you when and how you will be told the outcome of your X-ray.

**If you have any questions, please ask**

**Dental X-rays**

**Your health**  
 Dental X-rays help with making a diagnosis, planning treatment or monitoring the health of your teeth. They involve the use of ionising radiation (X-rays) to produce detailed images of teeth, gums and jaws.

**Radiation**  
 Everyone receives ionising radiation every day from radioactivity in the air, food we eat and even from space. The amount of radiation used for dental X-rays is similar to your everyday exposure over a few days, so the risks associated with them are very low for both adults and children. The main benefit of the X-ray is making the correct diagnosis or plan, or ensuring your teeth are healthy, so you can get the treatment that's right for you. The X-ray will have been approved by a specialist (usually your dentist) who has agreed that the benefit is far greater than the small risk from X-rays.

**Our staff and equipment**  
 Staff are trained to take the best possible images using the lowest amount of radiation. Equipment is regularly checked to make sure the test is safe and effective.

**Your test**  
 You may have your X-ray taken during your dental examination or you may need to go to an X-ray room, depending on the type of exam required to get the appropriate information. You will normally be informed of the outcome of the X-ray before you leave. If not, our staff will tell you when and how you will be told the outcome of your X-ray.

**If you have any questions, please ask**

**Communicating Radiation Benefit and Risk Information to Individuals Under the Ionising Radiation (Medical Exposure) Regulations (IR(ME)R)**

SoR CoR  
 Society of Radiographers / College of Radiographers

**Diagnostic scenario 1**

A child has been referred for a chest x-ray, which has been justified by the IR(ME)R Practitioner. The child's mother asks whether it is safe and seeks assurance that her child will not develop cancer as a result.

**Suggested dialogue:**

*The doctor looking after your child believes a chest x-ray will help to decide on the best treatment. A specialist in radiology agrees that this is the best test to answer the question your doctor has asked and that the benefit to your child of having the x-ray is greater than the risk.*

*A chest x-ray involves a very low dose of radiation, about the same amount of radiation that you would normally get in 2 to 3 days from the radiation that is naturally occurring all around us. This exposure to ionising radiation represents a very low risk to your child of developing a cancer in the future. The dose delivered will be kept as low as is practicable.*

**Diagnostic scenario 4**

A patient who has had multiple examinations involving exposures of ionising radiation asks how many examinations they can safely have.

**Suggested dialogue:**

*Each exposure must be justified which means an expert radiology practitioner believes there is sufficient net benefit to you of having this examination when weighed against the risks. Whilst the cumulative effect of your lifetime exposure to ionising radiation is taken into consideration, each new exposure is justified on its own merits and in light of the current question. The benefit to you is weighed against the risk of not having the examination and the availability of alternative techniques that do not involve ionising radiation. Each exposure is made using as low a dose of radiation as is reasonably practicable consistent with your individual needs.*

X-ray examination	Equivalent period of exposure from:	
	Background radiation	Radiation from time spent flying
Teeth Arms and legs/Hands and feet DEXA	A few days	<1hr
Chest/Head/Cervical spine	A few weeks	6hrs
Breast (mammography) Thoracic/Lumbar spine Abdomen/Pelvis Kidney isotope scan	A few months to a year	60hrs
Angiography CT chest scan/CT abdomen scan Bone isotope scan	A few years	600hrs

**RADIATION INCIDENT REPORTING**

- ALL ACCIDENTAL OR UNINTENDED RADIATION EXPOSURES SHOULD REPORTED AS INCIDENTS
- ACCIDENTAL – WRONG PERSON
- UNINTENDED – WRONG SIDE OR TOOTH, EQUIPMENT MALFUNCTION ETC
- HOSPITAL-BASED DENTISTRY – DONE VIA DATIX REPORTING SYSTEM
- THIS IS NOT A 'BLAME GAME'
- INCIDENTS SHOULD BE LEARNED FROM AND ACTION TAKEN TO PREVENT THE SAME INCIDENT HAPPENING AGAIN IN THE FUTURE
- INCIDENT SHOULD BE **INVESTIGATED** AND **LEARNING SHARED WITH ALL STAFF**

**QUIZ TIME!**



**FUNDAMENTALS OF RADIOLOGICAL ANATOMY**

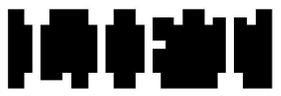
AIM

- TO ENABLE DENTAL NURSES TO IDENTIFY NORMAL ANATOMICAL STRUCTURES ON DENTAL RADIOGRAPHS FOR ACCURATE INTERPRETATION AND PATIENT CARE

LEARNING OBJECTIVES

- DESCRIBE NORMAL ANATOMY OF TEETH, JAWS AND SURROUNDING STRUCTURES, AS SEEN ON INTRAORAL AND EXTRAORAL RADIOGRAPHS
- IDENTIFY KEY ANATOMICAL LANDMARKS SUCH AS MAXILLARY SINUS, MANDIBULAR CANAL, MENTAL FORAMEN AND ALVEOLAR BONE
- DIFFERENTIATE BETWEEN NORMAL AND ABNORMAL ANATOMICAL FEATURES AND RECOGNISE VARIATIONS ACROSS AGE GROUPS
- APPLY KNOWLEDGE OF RADIOLOGICAL ANATOMY TO ASSIST IN ACCURATE IMAGE INTERPRETATION

VIEWING AND INTERPRETATION



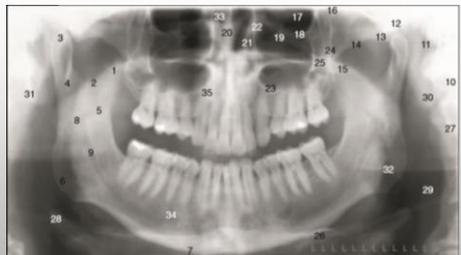
What do you see?



NORMAL RADIOGRAPHIC APPEARANCES

- ANATOMICAL SHADOWS (OPT)
  - **REAL SHADOWS** (AKA ACTUAL SHADOWS)
    - OF STRUCTURES IN, OR CLOSE TO THE FOCAL TROUGH
  - **GHOST SHADOWS** (AKA ARTEFACTUAL SHADOWS)
    - CREATED BY THE TOMOGRAPHIC MOVEMENT
    - CAST BY STRUCTURES ON THE OPPOSITE SIDE OR A LONG WAY FROM THE FOCAL TROUGH
    - THE 8 DEGREE UPWARD ANGLE OF THE BEAM MEANS THEY APPEAR AT A HIGHER LEVEL THAN THE STRUCTURES THAT HAVE CAUSED THEM

OPT ANATOMY?



ANSWERS

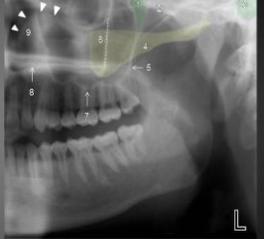
- |                                |                                       |   |
|--------------------------------|---------------------------------------|---|
| 1. Coronoid Process            | 13. Articular Eminence                | 25. Malar Process   |
| 2. Sigmoid Notch               | 14. Zygomatic Arch                    | 26. Hyoid Bone  |
| 3. Mandibular Condyle          | 15. Pterygoid Plates                  | 27. Cervical Vertebrae 1- 4   |
| 4. Condylar Neck               | 16. Pterygomaxillary Fissure          | 28. Epiglottis  |
| 5. Mandibular Ramus            | 17. Orbit                             | 29. Soft Tissues of Neck (Look Vertically For Carotid Artery Calcifications Here) |
| 6. Angle of Mandible           | 18. Inferior Orbital Rim              | 30. Auricle   |
| 7. Inferior Border of Mandible | 19. Infraorbital Canal                | 31. Styloid Process   |
| 8. Lingula                     | 20. Nasal Septum                      | 32. Oropharyngeal Air Space   |
| 9. Mandibular Canal            | 21. Inferior Turbinate                | 33. Nasal Air Space   |
| 10. Mastoid Process            | 22. Medial Wall of Max. Sinus         | 34. Mental Foramen  |
| 11. External Auditory Meatus   | 23. Inferior Border of Max. Sinus     | 35. Hard Palate   |
| 12. Glenoid Fossa              | 24. Posterolateral Wall of Max. Sinus |   |

'REAL' SHADOWS

- HARD TISSUE SHADOWS
  - TEETH
  - MANDIBLE
  - MAXILLA (INCLUDING FLOOR, MEDIAL AND POSTERIOR ANTRAL WALLS)
  - HARD PALATE
  - ZYGOMATIC ARCHES
  - STYLOID PROCESSES
  - HYOID BONE
  - NASAL SEPTUM AND CONCHAE
  - ORBITAL RIM
  - BASE OF SKULL

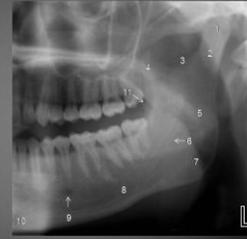
Maxillary, Temporal and Zygomatic structures

- 1 pterygopalatine fossa
- 2 pterygoid plate
- 3 ext. auditory canal
- 4 zygomatic arch
- 5 lateral wall maxilla
- 6 zygomatic buttress (dashed line)
- 7 inferior wall maxilla
- 8 hard palate
- 9 inferior concha (arrowheads)



Mandibular Structures

- 1 condyle
- 2 neck
- 3 sigmoid notch
- 4 coronoid process
- 5 ramus
- 6 inferior dental canal
- 7 angle
- 8 body
- 9 mental foramen
- 10 symphysis menti
- 11 external oblique ridge

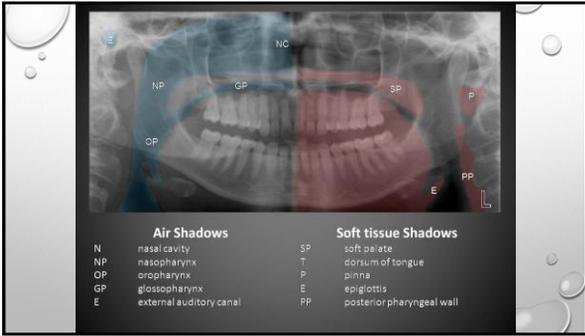


Surrounding Structures

- 1 articular eminence
- 2 glenoid fossa
- 3 anterior arch of C1
- 4 styloid process
- 5 body of C2
- 6 hyoid bone



- AIR SHADOWS
  - MOUTH / ORAL OPENING
  - OROPHARYNX
- SOFT TISSUE SHADOWS
  - EAR LOBES
  - NASAL CARTILAGES
  - SOFT PALATE
  - DORSUM OF TONGUE
  - LIPS AND CHEEKS
  - NASOLABIAL FOLDS



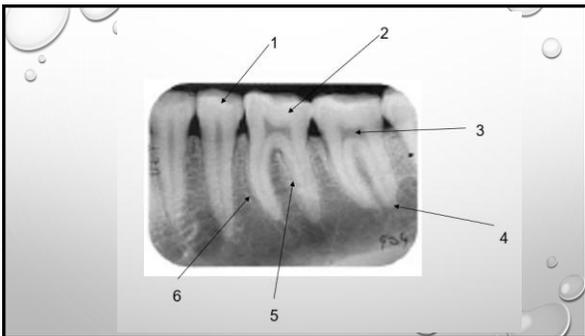
### 'GHOST' SHADOWS

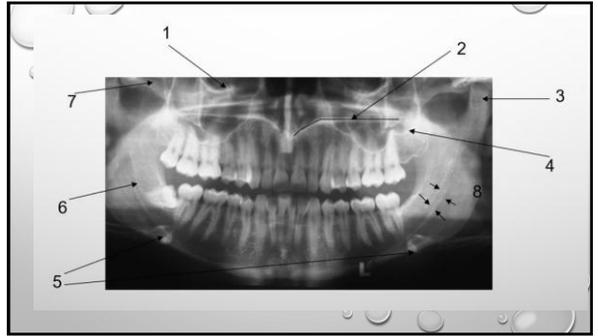
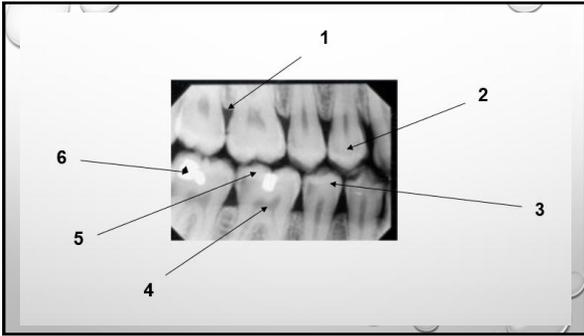
- CERVICAL VERTEBRAE
- BODY, ANGLE AND RAMUS OF THE CONTRA-LATERAL SIDE OF THE MANDIBLE
- PALATE



### Dental Anatomy

- E: enamel
- D: dentine
- PC: pulp cavity
- RC: root canal
- ACJ: amelo-cemental junction
- PL: periodontal ligament
- LD: lamina dura





### ACCURATE IMAGE INTERPRETATION

- KNOW YOUR ANATOMY WELL!
- IF YOU KNOW WHAT'S NORMAL, YOU WILL KNOW WHAT'S ABNORMAL
- IF YOU KNOW WHAT TO EXPECT WITH NORMAL ANATOMY, IT WILL BE EASIER TO IDENTIFY PATHOLOGY
- ALWAYS COMBINE IMAGE INTERPRETATION WITH **PATIENT HISTORY** AND FINDINGS OF **CLINICAL EXAMINATION**

### VARIATION ACROSS AGE-GROUPS

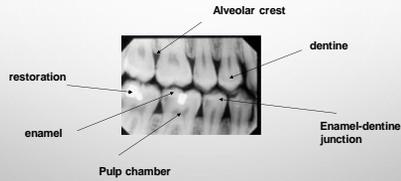
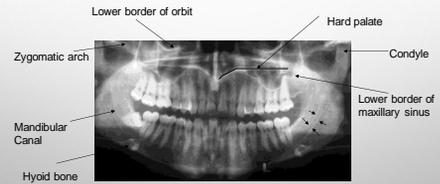
- DIFFERENT DENTITION PRESENT IN CHILDREN (ABCDE)
- MIXED DENTITION AS CHILDREN GET OLDER AND PERMANENT TEETH REPLACE DECIDUOUS ONES
- BONE MAY LOSE DENSITY WITH AGE
- BONE LEVELS WILL FALL AS PATIENTS GET OLDER
- MORE PERIODONTAL POCKETING AROUND TEETH WITH AGE
- MORE MISSING TEETH
- MORE RESTORATIONS APPARENT
- TMJ SPACE CAN BECOME NARROWER DUE TO ARTHRITIS

### NORMAL RADIOGRAPHIC APPEARANCES

**IOPA**

A close-up radiograph of a single tooth with labels: enamel, dentine, pulp, alveolar bone, Lamina dura, Periodontal ligament, and apex.

A close-up radiograph of a tooth with labels: Floor of Maxillary Sinus, Maxillary Sinus, Root Canal Filling, and Zygomatic Process.

**BITEWING****NORMAL RADIOGRAPHIC APPEARANCES****OPT****IDENTIFICATION OF COMMON DENTAL PATHOLOGY****AIM**

- TO EQUIP DENTAL NURSES WITH THE ABILITY TO RECOGNISE COMMON DENTAL PATHOLOGIES ON RADIOGRAPHS TO ASSIST IN DIAGNOSIS AND TREATMENT PLANNING

**LEARNING OBJECTIVES**

- IDENTIFY RADIOGRAPHIC SIGNS OF DENTAL CARIES, INCLUDING INTERPROXIMAL AND OCCLUSAL LESIONS
- RECOGNISE PERIAPICAL PATHOLOGY SUCH AS ABSCESSES AND GRANULOMAS ON RADIOGRAPHS
- DETECT PERIODONTAL DISEASE AND PATTERNS OF BONE LOSS USING BITEWING AND PERIAPICAL VIEWS
- UNDERSTAND LIMITATIONS OF RADIOGRAPHS IN DIAGNOSING PATHOLOGY AND THE NEED FOR CLINICAL CORRELATION
- APPLY APPROPRIATE REFERRAL PROTOCOLS WHEN ABNORMALITIES ARE DETECTED

**INTERPRETATION****MAIN OBJECTIVES:**

- TO IDENTIFY THE PRESENCE OR ABSENCE OF DISEASE
- TO PROVIDE INFORMATION ON THE NATURE AND EXTENT OF THE DISEASE
- TO ENABLE THE FORMATION OF A DIFFERENTIAL DIAGNOSIS
  - WHAT COULD IT BE? THERE COULD BE MULTIPLE OPTIONS BASED ON EXAMINATION AND IMAGING?

## Caries?



## CARIES

- CAUSED BY **PLAQUE** (BACTERIA)
- THESE LESIONS APPEAR AS **RADIOLUCENT**
- THEY BEGIN IN THE ENAMEL, CAN EXTEND INTO DENTINE AND EVENTUALLY MAY REACH THE PULP CAVITY
- WHEN THEY REACH THE PULP, IT WILL BECOME INFECTED AND MAY DIE
- THIS LEADS TO PUS AND AN ABSCESS FORMING

## CARIES RADIOGRAPHIC APPEARANCE

- AS LESIONS OF CARIES PROGRESS, THEY APPEAR AS **DIFFERENT-SHAPED AREAS OF RADIOLUENCY** ON A RADIOGRAPH
- FOUND IN THE CROWNS OR NECKS OF THE TEETH
- FAIRLY CHARACTERISTIC
- VARY ACCORDING TO **SITE** AND **SIZE** OF THE LESION
- CAN ALSO GET **ROOT CARIES** (IF THE ROOT OF THE TOOTH HAS BEEN EXPOSED DUE TO RESSION OF THE GUMS/BONE)

## CARIES DIAGNOSIS

- AREAS OF ENAMEL SHOULD ALL LOOK THE SAME COLOUR/DENSITY (BRIGHT WHITE)
- TRACE AROUND THE TEETH AND SEE IF THERE ARE ANY AREAS WHERE THE ENAMEL BECOMES MORE RADIOLUCENT (DARKER)
- THE CARIES MAY REACH THE DENTINE AND THEN START TO SPREAD OUT TO BECOME A MORE EXTENSIVE LESION

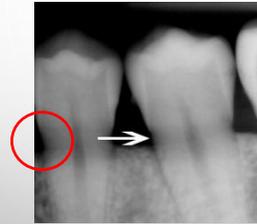


## OCCUSAL CARIES

- WILL BE EVIDENT IN THE CENTRE OF THE TOOTH (RADIOLUENCY)
- THIS IS WHEN CARIES HAPPENS IN THE OCCUSAL FISSURE
- IN ORDER TO BE SEEN IN AN INTRAORAL X-RAY, IT HAS TO BE QUITE **EXTENSIVE**
  - IT HAS TO BE SEVERE ENOUGH TO BE VISIBLE THROUGH SIGNIFICANT AMOUNTS OF ENAMEL AND DENTINE (WHEN VIEWING FROM THE BUCCAL SIDE)

### CERVICAL BURN OUT

- ARTEFACTUAL PHENOMENON
- CREATED BY ANATOMY OF TEETH AND VARIABLE PENETRATION OF THE X-RAY BEAM
- WHERE THE ENAMEL (DENSE) OF THE CROWN MEETS THE CEMENTUM OF THE ROOT (LESS DENSE)
- IT APPEARS AS A RADIOLUENCY SIMILAR TO CARIES, BUT:
  - HAPPENS AT NECK OF TOOTH
  - TRIANGULAR IN SHAPE, LESS APPARENT TOWARDS CENTRE OF TOOTH
  - USUALLY **ALL** TEETH ON IMAGE ARE AFFECTED



### PERIAPICAL TISSUES

- IMPORTANT FEATURES TO OBSERVE:
- **RADIOLUCENT (BLACK) LINE** THAT REPRESENTS THE PERIODONTAL LIGAMENT SPACE AROUND THE ROOT OUTLINE
- **RADIOPAQUE (WHITE) LINE** THAT REPRESENTS THE LAMINA DURA OF THE BONY SOCKET (OUTSIDE THE BLACK LINE OF THE PERIODONTAL LIGAMENT)
- **TRABECULAR PATTERN AND DENSITY** OF SURROUNDING BONE

### PERIAPICAL TISSUES

- THESE PERIAPICAL FEATURES HOLD THE KEY TO **INTERPRETATION OF PERIAPICAL RADIOGRAPHS**
- CHANGES IN ANY OF THE FOLLOWING CAN REFLECT THE PRESENCE OF UNDERLYING DISEASE
  - **THICKNESS** – IS THE BLACK LINE WIDER IN SOME AREAS?
  - **CONTINUITY** – IS THERE A DISRUPTION IN A CONTINUOUS LINE?
  - **RADIODENSITY** – HAS THE DENSITY CHANGED IN SOME AREAS?

### PERIAPICAL INFLAMMATORY CHANGES

- FOLLOWING PULPAL NECROSIS (INFECTION LEADS TO DEATH OF PULP TISSUES), EITHER AN ACUTE OR CHRONIC INFLAMMATORY RESPONSE IS INITIATED IN THE APICAL TISSUES
- SWELLING (TUMOR)
- REDNESS (RUBOR)
- HEAT (CALOR)
- PAIN (DOLOR)
- LOSS OF FUNCTION (FUNCTIO LAESA)

### APICAL PERIODONTITIS

- INFLAMMATORY EXUDATE (PUS) ACCUMULATES IN THE APICAL PERIODONTAL LIGAMENT SPACE (SWELLING)
- TOOTH BECOMES TENDER TO PRESSURE
- PATIENT AVOIDS BITING ON THIS TOOTH

## PERIAPICAL ABSCESS

- **ACUTE** INFLAMMATION
- DESTRUCTION AND RESORPTION OF THE TOOTH ROOT AND SURROUNDING BONE
- **RADIOLUCENT** AREA BECOMES EVIDENT ON RADIOGRAPH

## PERIAPICAL GRANULOMA

- WHEN INFLAMMATION IS **CHRONIC**
- PROCESSES OF DESTRUCTION AND HEALING ARE HAPPENING AT THE **SAME TIME**
- BODY'S DEFENCE SYSTEMS ARE TRYING TO RESPOND TO AND **CONFINE THE POTENTIAL SPREAD OF INFECTION**
- DENSE BONE IS LAID DOWN AROUND THE AREA OF RESORPTION
- PERIAPICAL GRANULOMA FORMS AT THE APEX OF THE TOOTH
- RADIOGRAPHICALLY:
  - **APICAL RADIOLUCENT AREA**
  - **CIRCUMSCRIBED AND SURROUNDED BY DENSE SCLEROTIC BONE**

## INFLAMMATION OF PERIAPICAL TISSUES

THESE STAGES OCCUR WHEN INFECTION IS STARTING AND PROGRESSING:

- (1) WIDENING OF THE RADIOLUCENT (BLACK) LINE OF THE PERIODONTAL LIGAMENT
- (2) LOSS OF THE RADIOPAQUE (WHITE) LINE OF THE LAMINA DURA AT THE APEX
- (3) AREA OF BONE LOSS AT THE TOOTH APEX
- (4) NO APPARENT BONE DESTRUCTION, BUT DENSE SCLEROTIC BONE EVIDENT AROUND THE TOOTH APEX (SCLEROSING OSTEITIS) – RADIOPAQUE
- (5) CIRCUMSCRIBED, WELL-DEFINED RADIOLUCENT AREA OF BONE LOSS AT THE APEX, SURROUNDED BY DENSE SCLEROTIC BONE

## WHERE'S THE PATHOLOGY?



## PERIODONTAL TISSUES

- WILL BE EXAMINED BY ASSESSING POCKETING (BPE)
- ASSESSED RADIOGRAPHICALLY VIA OPT, BITEWINGS AND IOPAS
- LOOKING AT LEVEL OF SUPPORTING STRUCTURES OF THE TEETH
- MAINLY ASSESSING **BONE LEVELS** AND **FURCATION INVOLVEMENT** (EXTENT OF BONE LOSS)
- IMAGES NEED TO BE EXCELLENT TO SHOW FINE DETAIL
- EXPOSURE FACTORS SHOULD BE REDUCED TO **AVOID BURN-OUT OF THE INTERDENTAL CRESTAL BONE**

### RADIOGRAPHIC FEATURES OF PERIODONTAL TISSUES

- LOOKING FOR EVIDENCE OF **PERIODONTAL DISEASE**
- NEED TO KNOW WHAT HEALTHY TISSUES ARE LIKE, WHEN THERE HAS BEEN NO BONE LOSS
- NEED TO ASSESS:
  - **RELATIONSHIP BETWEEN THE CRESTAL BONE MARGIN AND CEMENTO-ENAMEL JUNCTION (CEJ)**
  - **SHOULD BE 2-3MM NORMAL LIMITS**
  - **NO CLINICAL SIGNS OF LOSS OF ATTACHMENT**

### NORMAL RADIOGRAPHIC FEATURES OF ALVEOLAR BONE

- THIN, SMOOTH, EVENLY CORTICATED MARGINS TO THE INTERDENTAL CRESTAL BONE IN THE POSTERIOR REGIONS
- THIN, EVEN, POINTED MARGINS TO THE INTERDENTAL CRESTAL BONE IN THE ANTERIOR REGIONS
  - CORTICATION AT THE TOP OF THE CREST IS NOT ALWAYS EVIDENT, OWING MAINLY TO THE SMALL AMOUNT OF BONE BETWEEN THE TEETH ANTERIORLY
- THE INTERDENTAL CRESTAL BONE IS CONTINUOUS WITH THE LAMINA DURA OF THE ADJACENT TEETH. THE JUNCTIONS OF THE TWO FORMS A SHARP ANGLE.
- THIN, EVEN WIDTH TO THE MESIAL AND DISTAL PERIODONTAL LIGAMENT SPACES



### LIMITATIONS OF RADIOGRAPHS

- CLINICAL EXAMINATION IS STILL ALWAYS REQUIRED
- 2D REPRESENTATION OF 3D ANATOMY
- SIGNS OF HEALTHY TISSUES SHOULD BE APPARENT ON A GOOD QUALITY X-RAY TAKEN USING A RELIABLE TECHNIQUE
- THEIR ABSENCE DOES NOT NECESSARILY MEAN THAT DISEASE IS PRESENT
- FAILURE TO SEE THESE SIGNS:
  - **TECHNIQUE ERROR**
  - **OVEREXPOSURE**
  - **NORMAL ANATOMICAL VARIATION**

### CLINICAL EXAMINATION AND HISTORY

- **HISTORY** TAKEN AT BEGINNING
- **CLINICAL EXAMINATION** CARRIED OUT
- **SPECIAL INVESTIGATIONS** (RADIOGRAPHS) REQUESTED NEXT IF REQUIRED
- E.G PATIENT WAKING UP AT NIGHT WITH DENTAL PAIN, THEY HAVE PAIN WHEN THEY BITE ON THE TOOTH, POOR ORAL HYGIENE, DON'T ATTEND DENTIST REGULARLY
- PAINTS A PICTURE TO GIVE THE DENTIST A GOOD IDEA BEFORE RADIOGRAPHS ARE TAKEN
- SPECIFIC RADIOGRAPHS CAN THEN BE TAILORED TO INDIVIDUAL PATIENT

### REFERRAL PROTOCOLS

- WHEN ABNORMALITIES ARE DETECTED, IT IS IMPORTANT THAT PATIENTS ARE REFERRED TO THE APPROPRIATE DEPARTMENT/SPECIALTY
- DIFFERENT DEPARTMENTS DEAL WITH DIFFERENT PATHOLOGY (E.G. ENUCLEATION OF CYST IN ORAL SURGERY, ECTOPIC CANINES IN ORTHODONTICS)
- IT IS ESSENTIAL THAT THE PATIENT IS REFERRED TO THE CLINICIAN WITH THE CORRECT SPECIALIST KNOWLEDGE
- MOST ABNORMALITIES WILL BE INVESTIGATED AFTER CLINICAL EXAMINATION
- HOWEVER, SOME WILL BE FOUND AS AN **INCIDENTAL FINDING** (PATHOLOGY THAT IS NOT EXPECTED AND FOUND ACCIDENTALLY ON RADIOGRAPHS)

### SPOT THE FILM FAULTS!

**NONE OF US ARE PERFECT  
ALL OF THE TIME!**

