

BLX-5 型便携式高频 X 线机

Good morning

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RADIATION PROTECTION

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INTRODUCTION

Practitioners must be prepared to discuss intelligently, the benefits and the possible hazards involved with the use of x rays and be able to describe the steps taken to reduce the hazards

Practitioners who administer ionizing radiation must become familiar with the magnitude of radiation exposure encountered in medicine and dentistry, the possible risk that such exposure entails, and the methods used to affect exposure and reduce dose.

SOURCES OF RADIATION

NATURAL		ARTIFICIAL
<u>External sources</u>	<u>Internal sources</u>	Medical diagnosis and treatment
Cosmic radiation	Radon	Consumer and industrial products
Terrestrial radiation	Others	Other artificial sources

SOURCE	DOSE
cosmic	0.27
terrestrial	0.28
Radon	2.00
Other	0.40
Diagnostic x-rays	0.39
Nuclear medicine	0.14
Consumer products	0.60

GUIDELINES FOR RADIATION PROTECTION

- ❖ Recognition of the harmful effects of radiation and the risks involved with its use led the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP) to establish guidelines for limitations on the amount of radiation received by both occupationally exposed individuals and the general public.
- ❖ Since their establishment in the 1930s, these dose limits have been revised downward several times. These revisions reflect the increased knowledge gained over the years concerning the harmful effects of radiation and the increased ability to use radiation more efficiently.

GUIDELINES

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graph TD; A[GUIDELINES] --> B[MPD]; A --> C[ALARA]
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MPD

ALARA

MAXIMUM PERMISSIBLE DOSE

Is the amount of radiation that an individual is allowed to receive from artificial sources of radiation, except when the individual is a medical or dental patient.

This is a level of radiation dose that represents an acceptably low risk of harmful effects.

MPD is defined for 2 groups of persons:

- a) Occupationally exposed personnel
- b) Non occupationally exposed personnel

Cont.....

CLASS OF EXPOSED INDIVIDUALS	MAX PERMISSIBLE DOSE(mSv) per year
Radiation workers	50
General public	5
Trainees	50
Pregnant women	5

Also in case of pregnancy an occupationally exposed person would be allowed to receive a dose as low as non occupationally exposed person

A complete mouth survey of 20 E speed films, with rectangular collimation would produce a effective dose of 33 micro severts



4.1 days

Panoramic radiograph \longrightarrow 26msv \longrightarrow 3.3 days

❖ Using the MPD guidelines an occupationally exposed operator expose 4000 panoramic radiographs per week with PROPER SEFETY PROCEDURES.

Oral radiology principles and interpretation: White and Pharaoh

cont....

With properly working x ray equipment, properly designed office and proper dental radiographic procedures, x ray machines should not cause any occupational or non occupational person to receive anywhere near the MPD.

“ALARA” CONCEPT

ALARA- As Low As Reasonably Achievable

According to this concept every reasonable measure should be taken to assure that occupationally and non occupationally exposed person will receive the smallest amount of radiation possible.

METHODS OF DOSE AND EXPOSURE REDUCTION

Patient protection

Operator protection

PATIENT PROTECTION

Decision for selection of radiograph

Measures taken at the machine

Measures taken at the chair

Measures taken in the darkroom

SELECTION OF RADIOGRAPH

Operator should expose no one without a good reason.

❖ diagnostic radiology should be used only after consideration of the patients history, clinical examination and consideration of dental and general health needs of the patients.

Clinical situations for which radiographs may be indicated:

Positive historical findings:

1. Previous periodontal or endodontic therapy
2. History of pain or trauma
3. Familial history of dental anomalies
4. Post operative evaluation of healing

Positive clinical signs or symptoms:

1. Clinical evidence of periodontal disease
2. Large or deep restorations
3. Deep carious lesions
4. Swelling
5. Clinically impacted teeth
6. Evidence of facial trauma
7. Fistula or sinus track infection
8. Growth abnormalities
9. Pain and/or tmj dysfunction etc.....

Measures taken at the x ray machine

KVP

The x ray machine should be operated at the highest KVp consistent with a good image, usually 70 to 90 kVp.
An x ray machine that is incapable of being operated at least at 60 kVp should not be used.

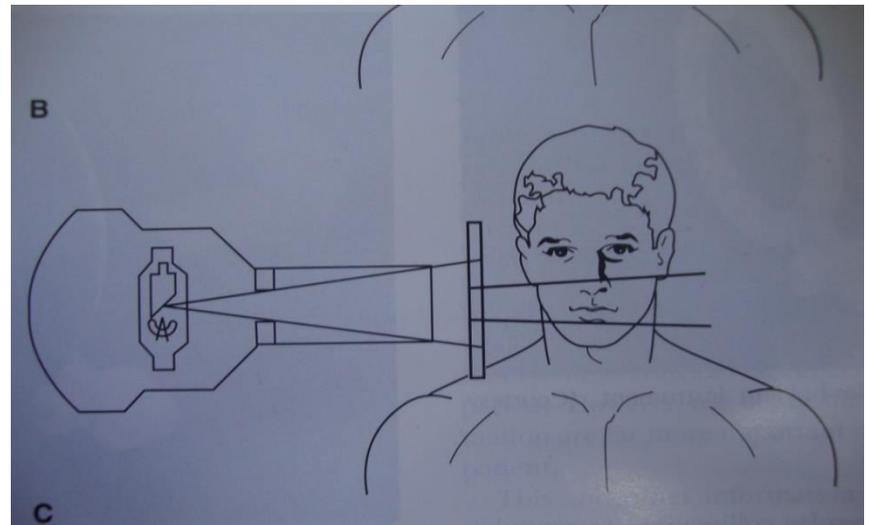
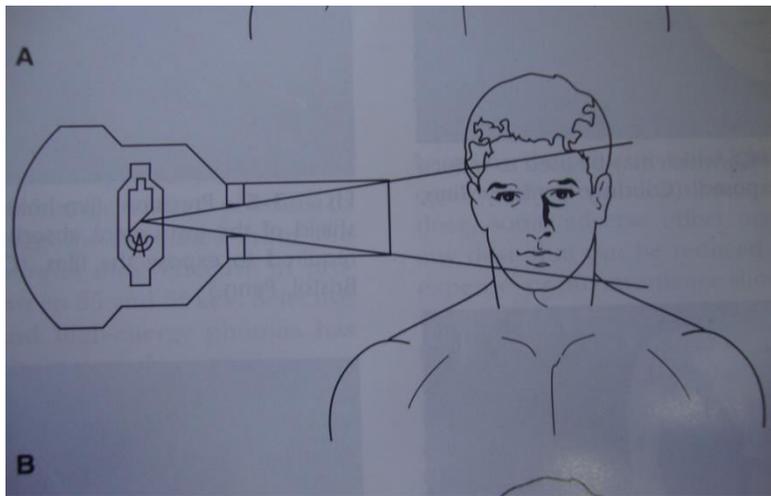
FILTRATION

Filtration preferentially removes the soft low energy, long wavelength x rays from the beam.
A dental x ray machine operating at 50 to 69 kVp should have at least 1.5 mm of Al equivalent filtration.

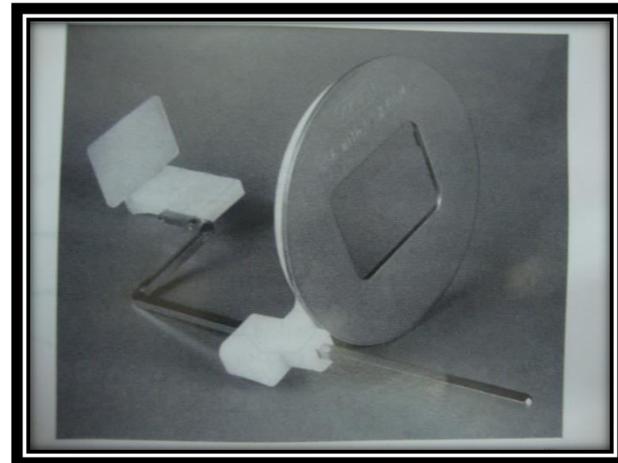
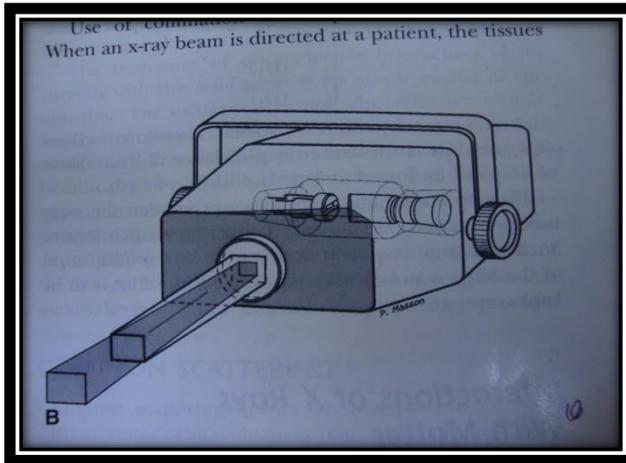
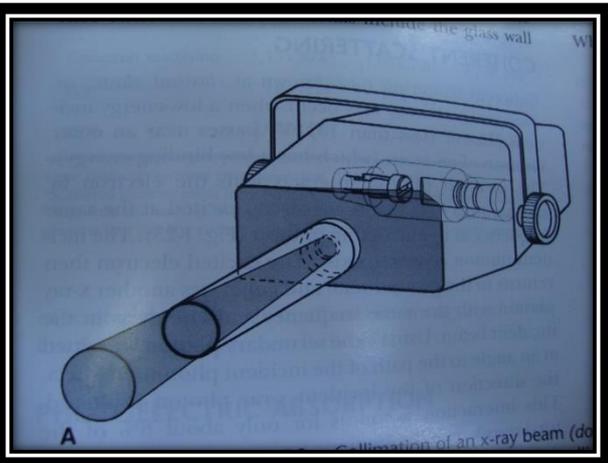
COLLIMATION

Collimation is the restriction of the cross sectional area of the beam and is usually done with help of a device called collimator.

Collimation of the beam is required by the federal law at the skin surface to be limited to a circle having a diameter of not more than 7cm or 2.75 inch.



- A collimator is a metallic barrier with an aperture in the middle used to reduce the size of the x ray beam.
- Round and rectangular are most frequently used.
- Rectangular collimator limits the size of the beam to just larger than x ray film.
- Some type of film holders also provide rectangular collimation.



TIMER

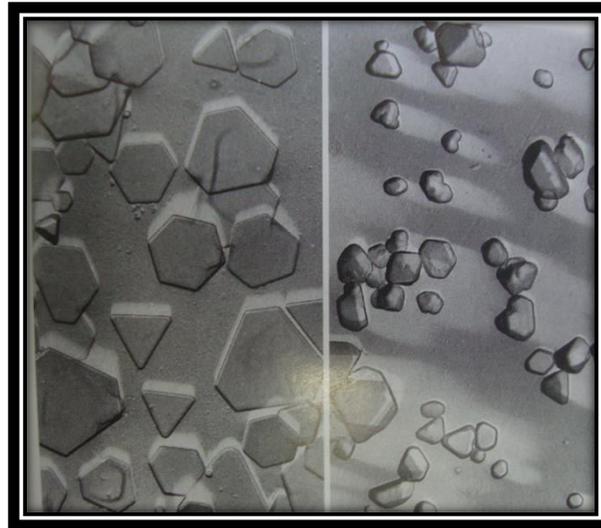
- The timer on the x ray machine should be electronic.
- Mechanical timers are imprecise.
- The timer should have a dead man control.
- The electronic timer is calibrated in 60th of a second, corresponding to 60 cycles per sec of AC current that powers the machine. Each 1/6th of a second exposure results in 1 pulse of x ray production.



MEASURES TAKEN AT THE CHAIR

1. Film speed

- E+ films are the most appropriate.
- Speeds of dental x rays are described with letters ABCDE with A being the slowest and E being the fastest.



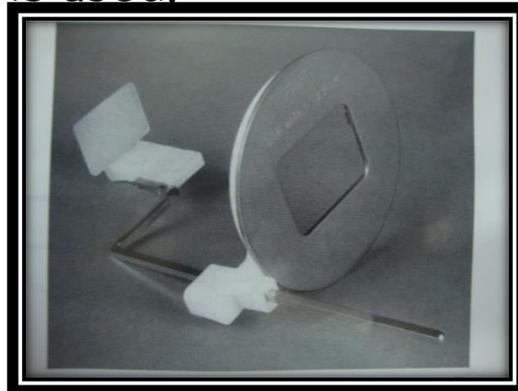
INTENSIFYING SCREENS

- Patients exposure during panoramic and other extra oral projections can be further reduced by using rare earth intensifying screens and high speed films
- When green sensitive T-grain film is used with rare earth -green-light emitting screens, it was found that this film-screen combination is twice as fast as conventional calcium tungstate screen film combination (Miles et al 1989)

In panoramic and cephalometric x-ray machines, selective filtration of both low and high energy photons with rare earth materials, in combination with aluminum filtration, has found to reduce the exposure by 20% to 80% compared with conventional aluminum filters alone

FILM HOLDING DEVICES

- The purpose of this device is to avoid using patients finger to hold the film in place, thus avoiding an unnecessary dose to the fingers.
- It is used to properly align the film with teeth, and the BID with film; and to avoid retaking radiographs caused by improper alignment
- Film holding devices are especially useful if rectangular BID(collimation) is used.



PROTECTIVE APRONS AND THYROID COLLARS



- The patient should be provided with leaded aprons and thyroid collars
- Torso apron reduces genetic exposure by 98%
- Thyroid collar reduces thyroid dose by 50%



MEASURES TAKEN IN THE DARK ROOM

DARK ROOM LIGHTING

- The dark room must be kept free of light leaks
- An appropriate safelight filter should be used
- Red safelight filter should be used which is the universal safelight filter for intraoral and extra oral films.

PROCESSING

- When radiographs are developed by manual method, time/temperature processing is absolutely essential.
- In all instances full development should be used(eg: 5 min at 70 degree)
- The exposure time can be reduced by 25% without interfering with the quality of image if full development is given.
- Processing solution should be periodically changed, stirred twice a day, kept covered to prevent oxidation when not in use.
- Chemicals should be replenished according to manufacturers instruction.



VIEW BOX

VIEW BOX

- Radiographs should be mounted properly and viewed in a dimly lit room with a properly *functioning* illuminator.
- An illuminator with *variable intensity* is helpful when viewing radiographs that have been overexposed or under exposed.
- If all the other steps have been followed but the radiographs are not viewed under ideal conditions, images could be misinterpreted.

Operator radiation protection

- Every possible measure has to be taken to protect ourselves from being exposed to radiation, no matter how small the dose is. Because radiation workers are at a higher risk of radiation induced damage.
- There are several procedures operator can use to minimize their occupational exposure in dental office. Most of them are based on certain *fundamental concepts concerning x rays, like*
 - They travel in straight line
 - Intensity decreases as distance increases,
 - X rays can be scattered in their path

The operator could be exposed to radiation directly from the primary beam, leakage radiation, or from scattered rays from patients skull.

POSITION

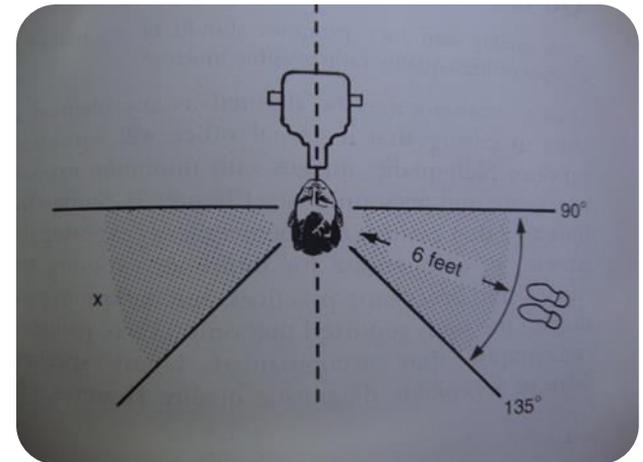
SHIELDING

DISTANCE

POSITION AND DISTANCE

An effective way to reduce operator exposure is to enforce strict rule of distance and position rule.

ie., the operator should stand at least 6 feet distance away from the source and at an angle of 90 to 135 degrees to the primary beam.



If it is not possible----- protective barrier

The tube head should never be held or stabilized during exposure

Dentists, hygienists, assistants should never standing line with the primary beam to restrain a patient.

Using the MPD guidelines for occupationally exposed individual of 1mSv per week, ban operator can could conceivably expose 4000 panoramic radiographs per week with safety if he or she stood 2 meters away.



SHIELDING

A lead shield has to be used to shield oneself if the operator has to stand within 6 feet from the machine.



If shielding is not possible the operator has to stand outside the room behind a wall.

The walls of the dental operator must be of sufficient density and thickness to limit the x rays.

A wall of gypsum has been found to be sufficient



- Radiation dosimetry monitoring services subscribing to one of the many film badge services provides an excellent tangible way to express concern for reducing and monitoring radiation exposure to office staff.
- Monitoring is recommended for a period of 3-6 months
- The film badge contains lithium fluoride crystals. When they are turned to company the badge is processed and compared with known amount of radiation

CONCLUSION

All dental radiation workers in dental office or clinic have the responsibility to produce high quality diagnostic radiographs. These workers must be competent in their techniques, and be aware of what constitutes of proper processing and handling

Strict adherence to the principles of patient management, techniques, film handling, processing will eliminate needless exposure and reduce the dose.

REFERENCES

- Text book of oral radiology: White and Pharoah
- TB of oral radiology Anil Govindrao Gohm
- Principles of dental imaging: langlais and Lanland
- TB of oral radiology Paul Goaz

Thank you