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RESEARCH ARTICLE

ZAPPED: RADIOLOGY IN PEDIATRIC DENTISTRY

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Abstract

Radiographs are an integral part of in a Pediatric Dental practice. Their use in diagnosis and treatment planning cannot be refuted. There are various radiographs available for this purpose -IOPA (conventional and RVG),Orthopantogram (OPG) and latest being Cone – beam computed tomography (CBCT) with their advantages and disadvantages .Every time radiograph is taken, child is exposed to radiation Children are more sensitive to the X-rays as compared to adult. The knowledge of the exposure time ,effective radiation dose of various radiographs in children help us to make an informed decision on their use .The type and number of x-rays taken in children need to be limited and justified. Ill effect of radiation on sensitive developing cells of a child has dangerous and long term effects which need to be taken into consideration. while selecting the radiograph to be taken.

Introduction:-

Pediatric dentistry is a specialized field focused on delivering primary and comprehensive preventive and therapeutic oral health care to infants, children, and adolescents. This includes providing care for those with special health care needs.[i]

The discovery of X-ray brings massive change in medical as well as in the field of dentistry specially in pediatric dentistry. Radiographs are integral part in a pediatric dentistry, Providing valuable information that aids in diagnosis and treatment planning in children. The various radiographs are available for this purposes are IOPA (conventional and RVG), OPG and CBCT . each with different dose, exposure time, advantages and disadvantages and indications.

The knowledge and awareness about the exposure time and radiation dose of various radiographs need to be taken into consideration while choosing a radiograph specially for the child to prevent overexposure and reduced undue to exposure to radiation as children are more sensitive to radiation. This narrative literature review aims to highlight the use of x-ray in pediatric dental set up.

IOPA (Conventional)

Intraoral periapical radiograph is an 2D radiograph technique .This 2D radiographs used in the detection and extension of caries. The radiation dose of 5µSv for single E speed film and 2 µSv for single F speed film with exposure time 0.05-0.08 sec, hence F speed film is preferable in children.[ii,iii] The advantages of this method include its low cost and minimal radiation exposure compared to other radiographs. However, the images cannot be reproduced, and the angle needs to be adjusted for each patient. Incorrect angulation can result in images that are

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foreshortening or elongation. It's limitation mislves to detection of proximal caries, and the periodontal bone levels are poorly shown.[iv]

IOPA(RVG):
RVG utilizes digital sensor to obtained highly detailed and instant image, making it better option in pediatric care. Low radiation dose than conventional IOPA with exposure time 0.2.0-0.30 sec [2.] The indications for RVG are similar to those for IOPA. However, the size of the digital sensor can be uncomfortable for children, and incorrect placement of the sensor can result in superimposed images, which can affect diagnostic accuracy.[v,vi]

Orthopantomogram Radiograph (OPG):
Panoramic radiography is an 2D extraoral radiographic technique. It provides a single comprehensive and detailed images of jaws and maxillofacial structures. The exposure dose is 6-26µsv with exposure time 12-20 sec which is low when compared to full mouth conventional radiographs.[2] It is also useful for patients with trismus or those who cannot tolerate IOPA. However, the images have lower resolution and do not provide fine details, and unequal magnification can make linear measurements and diagnoses unreliable. Additionally, the images may include superimposed real, double, and ghost images. The equipment and machines are expensive. [3,6]

Cone –Beam Computed Tomography (CBCT):
CBCT Is 3D extraoral imaging technique which was first introduced in Europe in 1996 and then in US in 2001. It is used to assess hard and soft tissues mainly for location and extension of pathological lesions, examples are cyst, tumors.[vii] The exposure time is 20-80 sec and exposure dose ranging from 18.5µSv - 182µSv depending upon the area of consideration.[2,3] The exposure time and radiation dose is significantly higher than other dental radiographic techniques, except CT-SCAN.[7] The clinical benefit must balance the potential effect considering the cumulative effect of ionization radiation in children. The advantages of this method include controlled magnification, no superimposition or distortion of images, and higher image accuracy. Image noise can occur due to the large volume being irradiated during CBCT scanning, and it has poor soft tissue contrast with more scatter radiation. The ionizing radiation may have a long lasting effect on sensitive cells of growing child.[7,viii]

Radiation Protection In Children:
Thyroid Collar And Lead Aprons
The thyroid gland is the most common radiosensitive organ in the head and neck region because it is often exposed to scatter radiation and sometimes to the primary beam of radiation. Using a thyroid collar and lead apron and lead barrier wall is a must to minimize the radiation dose, by 33-84 % in adults and 63-92 %t in children.[3]

An X-ray filter removes low-energy photons that don't help with imaging and are mostly absorbed by the patient. Using an aluminum filter that reduces the skin dose to the patient, is recommended to use 1.5 mm aluminum at 60-70 kVp and 2.5 mm aluminum above 70 kVp. [3,ix]

Discussion:-
X-rays have vital role in diagnosis and treatment planning especially in deciduous dentition of children. X-rays cannot be substituted but their knowledge can help choosing the type of x-rays required to obtained maximum information with minimal possible exposure.

Radiation is more harmful for children because they are more sensitive to it than adults. This sensitivity is due to their developing bodies and the high rate of cell division, which can lead to damage to DNA metabolism. Children's tissues also have higher water content, so they absorb more radiation and require more radiation dose to penetrate a layer of tissue of the same thickness. Additionally, the proportions of a child's body is different than those of an adult; children have shorter and broader bodies, meaning a larger area of a child's body will be in the radiation field. So radiation induced malignant lesion risk is higher in children and can remain latent for years. This along with fact that children are more radiation risk than adult, warrant judicious approach towards the choice of radiograph.[9,x] There are no studies that can be conducted on radiographic exposure or on CBCT due to ethical implications, and all the evidence obtained is from retrospective evaluations.[xi]

Table 1:-

RADIOGRAPH TECHNIQUE	IOPA	RVG	OPG	CBCT
EXOPSURE TIME	0.50-0.80 sec	0.20-0.30 sec	12-20 sec	20-80 sec

EXPOSURE DOSE	5-35 µSV	LESS THAN IOPA	6-26 µSV	18.5 -182 µSV

This chart shows the difference in exposure time and exposure dose of the various radiographic techniques. To minimize the radiation risk in children, it is prudent to follow the ALARA

[As Low As Reasonably Achievable] principle of radiation along with the guidelines given by AAPD. According to AAPD, to minimize patient exposure to radiation in dental imaging, it's important to follow good practices. Use the fastest image receptor (like F-speed film or digital options such as PSP plates or CCD), collimate the beam to the receptor's size, use proper film exposure and processing techniques, wear protective aprons and thyroid collars, and limit the number of images to only what is necessary for diagnosis.[1,2]

Conclusion:-

Each type of radiograph has specialized purpose and gives details of specific region. The type of radiograph and number of radiograph needs to be justified keeping the various parameters that have been discussed in mind. Therefore, we should use radiographic techniques judiciously, considering both exposure time and radiation dose in children.

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