

## Chapter 8

# Comparison and Analysis of Dental Imaging Techniques

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### ABSTRACT

*Fluoride dental decay is the second most common disease around the world. Detection methods for early disease are very crude. Precise oral diagnosis and treatment are very strongly connected to the quality of dental imaging techniques which advances the diagnostic procedure. To study the external appearance of the teeth arches, 2D images are used. CBCT images were used to locate the bone at dental implant sites. Fiberoptic transillumination, fluorescence imaging detects caries. For qualitative and quantitative analysis of dental applications, laser-induced breakdown spectroscopy (LIBS) is used. Electron caries monitor (ECM), fiberoptic transillumination (FOTI), digital fiberoptic transillumination (DIFOTI), quantitative light-induced fluorescence (QLF) are also some of the detection methods used. Hence, in this chapter, the methodologies are analyzed and compared for easy use of the dentist.*

### INTRODUCTION

As dental lesions develop they can be noticed using X-rays. Radiopacity is a useful property of implants used in dental analysis. They alternate energy differently than surrounding body tissues. Computational models of dental image analysis address several problems. Image modalities rely on X-ray images, even though Ultrasound, CT and MRI provide more accurate interpretations. For investigation and visualization of teeth, 2D images are used which do not provide adequate information. Photogrammetric approach gives solutions with required accuracy and for treatment planning with 3D models. CBCT images are used to locate the bone at dental implant sites. Optical methods were developed for Caries detection based on quality modification of tooth configurations which comprise Fiber Optic Trans illumination (FOTI), fluorescence, photo thermal radiometry, multi photon imaging and optical coherent tomography. Some investigations with laser and light induced fluorescence have demonstrated lesion detection. For qualitative and quantitative analysis of dental applications, Laser-induced breakdown spectroscopy (LIBS) is used. Some recent methods used for detection of dental infections are Electron Caries Monitor, Fiber optic trans-illumination, Digital Fiber optic Trans-illumination, Quantitative Light Induced Fluorescence, etc.

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In this chapter the dental imaging techniques will be discussed, analyzed and compared as the detection methods will have their own advantages and disadvantages. Hence it will be useful for the dentist for identification and selection of technology to make the dentist feel more confident and comfortable.

## **DENTAL IMAGING USING X-RAYS**

One of the best biomedical field accomplishments with the examination of vacuum tubes in the nineteenth century, prompted the disclosure of x-rays by Wilhelm Conrad Roentgen. Analysts doing research on x - rays experienced repeated radiation which harmed the tissues. Today the innovation has enhanced on the x-ray hardware, photographic film and its advanced strategies are utilized for different medical applications.

In 1895, Professor Wilhelm Conrad Roentgen made an attempt to investigate the cathode beams. He found that the x-rays could enter thick materials to varying degrees. Combining the information that specific materials would assimilate the light emission beams when put in its way, Roentgen exhibited that a picture of dense object could be caught on the photographic plate (Davis, 1981; Dhaliwal, Singh, Kapila & Rajput, 2012).

The revelation of the unknown beams in the year 1895 denoted a novel period in the field of dental surgery. In dental surgery, significant advancement was accomplished through the new potential outcomes of a radiological examination. The primary skiagraph (a photographic picture created on a radiosensitive surface by radiation other than unmistakable light - particularly by X-rays or gamma beams) of the tooth was introduced by Professor Koenig in the month of February, 1896, to the Frankfurt Society of Physics during. During the month April, of that year, Dr. Walkhoff exhibited numerous skiagraphs of the teeth in the human subject at the Congress of Erlangen. Dr. W. J. Morton has written a research article which became visible in June 1896 at the Dental Cosmos, on “The X-rays and their Application in Dentistry” (Friedman & Friedland, 1998). In the next few years, radiographs emerged and were utilized for the therapeutic analysis and dental conditions, for treatment using x-rays and for technical research (Dhaliwal, Singh, Kapila & Rajput, 2012).

## **BASICS OF DENTAL RADIOLOGY**

Radiography taken from the mouth called as oral radiography is the recording of the patients oral structures recorded on an x-ray film using x- rays. Like visible light energy, X-rays are electromagnetic beams that travel in a wave movement. The measurement of this wave movement is known as a wavelength. X-rays contain an amazingly small wavelength that empowers the beam to go through materials that typically attract or return the light energy or other electromagnetic beams with longer wavelengths. In spite of the fact that X-rays contributes to the properties of other electromagnetic beams, their activities are extensively unique. A portion of the properties and characteristic features of X-rays are:

- They take a straight line path.
- When they penetrate an image is produced in the x-ray film.
- It causes fluorescence of certain substances.
- When the cells are exposed to x-rays they degenerate.

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