



Intraoral image receptors-An insight.

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ABSTRACT:

Image receptors still remain one of the most important imaging modalities available in dentistry. They provide high spatial resolution imaging of teeth. They yield the essential diagnostic information for dental treatment planning. It is very essential for the dentist to know basic constituents of image receptors to minimize errors that happen during storage and handling of image receptors. This brief review provides an insight into basic components of an image receptor.

KEY WORDS: Radiographs, Image receptors, X-rays

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Image Receptor:

Definition:

Radiographic film or image receptor is the recording medium on which images are recorded when the film is exposed to a stimulus-specifically, energy in the form of x-radiation or light. The term image refers to a picture or likeness of an object and the term receptor refers to something that responds to a stimulus.¹

History:

The earliest image receptor in radiography were made in 1895 by Dr.Wilhelm Conrad Roentgen using photographic plates.The photographic plate was replaced by photographic paper and then by photographic film. The substitute material, cellulose nitrate, soon became the standard base. Cellulose nitrate, however had one serious disadvantage of being flammable.^{2,3}

In April 1896 William J Mortan used roll film which has to be cut to size, then wrapped in rubber and black paper so that the packet was light proof and then used, which proved to be cumbersome. By 1900 Weston A Price, dentist from Cleveland designed a celluloid based dental film. In 1909, C Edmund Kells reported that he was cutting, wrapping and using roll type photographic film to make dental radiographs. However, despite their

cost, weight, bulk, fragility and patient discomfort, glass plates continued to be used. In 1913, a hand wrapped, moisture proof dental packet containing two films was placed in the market.^{2,3}

The first machine wrapped X-ray film packed called regular film,[Kodak] became commercially available in 1919.This film had emulsion on one side and was relatively slow; a molar exposure required 8-9 seconds. However produced sharp images. Five years later, the double emulsion films became commercially available. This reduced exposure by 50% and also reduced the tendency of film to curl when dried. The double emulsion was marked by Kodak under the name of Radiatized film. ^{2,3}

In 1940, Eastman Kodak released the improved Radiatized or the ultraspeed film into the market. The speed of this film was double that of original Radiatized film. However with the increased film speeds there was an accompanying increase in graininess of image. In the early 1980s, Kodak released the Ektaspeed film, which again reduced the exposure by 50%. Studies reported that the E- film was faster and had the same or slightly lower contrast and had resolution equal to that of D speed film.⁴

Kodak Ektaspeed plus, the successor of Kodak was introduced in 1994.It had advantages of E-film but with contrast comparable to Ultraspeed film images. In April 2000 Eastman Kodak company released yet another film called Kodak Insight, classified as an F-speed intraoral film.^{5,6}

Composition of Film:

An X- ray film is composed of two principal components: the emulsion and the base.^{7,8}

The emulsion is the material in which X-rays or light photons from the screen interact and transfer in formation. The emulsion consists of a homogenous mixture of a vehicle and silver halide crystals.

The vehicle composed of gelatinous or a non gelatinous material. It is clear, so that it transmits light and it is sufficiently porous for the processing chemicals to penetrate the crystals of silver halide crystals during processing. Its principle function is to provide mechanical support for silver halide by holding them evenly dispersed.⁹

The silver halide crystal is the active ingredient of the radiographic emulsion. In a typical emulsion 95% of the silver halide crystals is silver bromide, the remainder is usually silver iodide.⁹

The shape and size of the silver halide crystals vary with the type of dental film. In an Ultraspeed film the crystals were smaller, approximately 0.7 μ m. The silver halide crystals in Ektaspeed film was approximately 1 μ m. These films had globular crystals. The Insight film came with flat tubular crystals with mean diameter of 1.8 μ m. The tubular grains of Kodak Insight film are oriented parallel to the film surface to offer large cross sectional area to the X- ray beam.¹⁰

The photosensitivity of silver halide crystals also depends on the presence trace amounts of a sulfur containing compound such as allylthiourea, silver sulfide or gold. These contaminants either intrude into the crystal lattice or reside on the surface. These types of contaminants are called the sensitivity specks or latent image sites.¹¹

2. Base:

The base of the dental film is made of polyethylene terephthalate and is 0.18 mm thick. Its primary purpose is to support the emulsion of light-sensitive silver halide grains and gelatin. The base is flexible and unbreakable to allow easy handling but is sufficiently rigid to withstand exposure to processing solutions.¹¹ The base is of uniform lucency nearly transparent to light so that there is no unwanted pattern or shading on the film. During manufacture, a dye is added to the base to give it a slight bluish tint.¹²

To ensure good adhesion to film base, a thin layer of adhesive material is added to the base before emulsion is applied. This adhesive is nothing but a thin layer of gelatin. An additional layer of transparent vehicle is added to the film emulsion as an overcoat. This barrier helps protect the film from damage by scratching, contamination or pressure from rollers when automatic processor is used ^{11,12}

TYPES OF RADIOGRAPHIC FILMS:

Films used in radiographic imaging can be classified as:^{11,12}

1. Direct action or non screen films
2. Indirect action or screen films.

The direct action or non screen films are sometimes referred to as wrapped or packet films. Direct action films are used in intraoral radiography where the need for excellent image quality and fine details are of prime importance. These films have emulsion coated on both sides of the base enabling it to produce an image with less radiation. Thus it is called double emulsion.

Indirect-action or screen film, is used in combination with intensifying screens in the cassette. This type of film is sensitive primarily to light photons which are emitted by the intensifying screens.

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