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ADVANCES IN PEDIATRIC DENTISTRY

Advances in pediatric dentistry have led to improved treatment for children with cavities, gingival disease, and other dental problems. New technologies such as digital X-rays, laser treatments, and 3D imaging have made it easier for pediatric dentists to diagnose and treat dental issues quickly and accurately. In addition, advances in dental materials have made it possible for pediatric dentists to provide more comfortable and aesthetically pleasing treatments.

A-Advances in diagnostic aids

Early detection is critical in the management of dental caries. When detected at an early stage at which the enamel surface has not collapsed, the **incipient lesion** can be treated with preventative therapies that can retard and eventually arrest the progression of early lesions and preserve the enamel tooth structure, function, and aesthetics.

Novel diagnostic systems are based upon the measurement of a physical signal these are substitute measures of the caries process. Examples of the physical signals that can be used in this way include X-rays, visible light, laser light, electronic current, ultrasound, and possibly surface roughness. For a caries detection device to function, it must be capable of initiating and receiving the signal as well as being able to interpret the strength of the signal in a meaningful way. A range of new caries detection systems have been developed include

I-Digital radiography is a filmless technique for intraoral radiography, utilizes very little of the radiation to which the patient has been exposed and avoid the need for developing films. This technique has offered the potential to increase the diagnostic yield of dental radiographs.

Advantages

1– The image is displayed immediately and no need of processing

2– Reduction in radiation dose

3– Digital manipulation of the image is possible to enhance the viewing

4 – It can be used as a visual aid to be shown to the patient on the computer screen

5 – It increases the confidence and credibility in the treatment-decision making process.

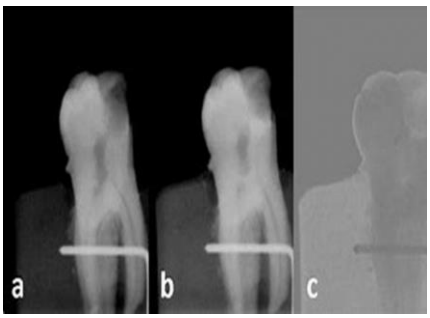
Disadvantages

1-The rigidity and thickness of sensor can cause discomfort to the patient

2- The lifespan of sensor is unknown

3– High initial system cost

II- Digital Subtraction Radiography (DSR)



It is a more advanced image analysis tools which allows professionals to distinguish small differences between subsequent radiographs that otherwise would have remained unobserved because of over projection of

anatomical structures or differences in density that are too small to be recognized by the human eye.

• The procedure is based on the principle that two digital radiographic images obtained under different time intervals

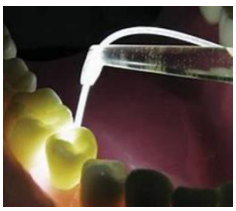
• If the two digital images are identical, this method will produce an image without details (the result is zero).

• When there is caries progression, the outcome will be a value above zero (increase in pixel values).

• In case of caries regression, the result is opposite, and the outcome will be a value below zero (decrease in pixel values)

• The major disadvantage of this technique is very sensitive to any physical noise occurring between the radiographs and even minor changes leads to large errors in the results

III- Fiberoptic Transillumination (FOTI)



It is a practical method of imaging teeth in the presence of multiple scattering. The illumination is delivered via light source to tooth surface. The light propagates from the fiber illumination across tooth tissue to nonilluminated surfaces. The resulting images of light distribution are then used for diagnosis. Carious area appears as darkened shadow that follows the decay. It is used for diagnosis of caries and identification of necrotic canals.

IV-Quantitative Light-induced Fluorescence (QLF)

The QLF equipment is comprised of a light box containing a xenon bulb and a handpiece, similar in appearance to an intraoral camera. Light is passed to the handpiece via a liquid light guide and the handpiece contains the bandpass filter. Live images are displayed via a computer and accompanying software enables patient's details to be entered and individual images of the teeth of interest to be captured and stored. Once an image of a tooth has been captured, the next stage is to analyze any lesions and produce a quantitative assessment of the demineralization status of the tooth. This is undertaken using proprietary software and involves using a patch to define areas of sound enamel around the lesion of interest.

Following this, the software uses the pixel values of the sound enamel to reconstruct the surface of the tooth and then subtracts those pixels, which are considered to be lesion.

• **Advantages** are high reproducibility, detection of small incipient lesions in enamel and dentin, image storage and transmission and can act as motivational tool for patient.

• **Disadvantage** is that it is an isolation sensitive procedure.

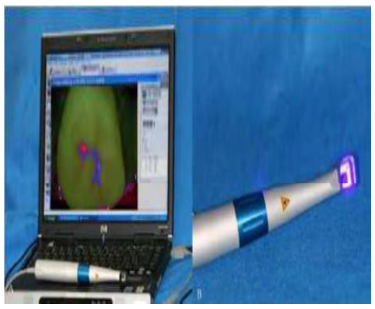
V-Digital Imaging Fiberoptic Transillumination

This is a new method for detection of dental caries in which the images of teeth are obtained through visible light fiberoptic transillumination and digital CCD camera (charge couple device). These images are then sent to a computer for analysis with specific algorithms. These algorithms are developed to facilitate the location and

diagnosis of the carious lesion and provide quantitative characterization for monitoring the lesions.

• Advantage is that it can indicate the presence of incipient and recurrent caries even when radiological images fail to show their presence.

VI-Fluorescence Camera (Vista Proof)



This device is an intraoral camera which consists of six blue LEDs emitting a 405- nm light, charge couple device (CCD) sensor and software for analysis. With this camera it is possible to digitize the video signal from the dental surface during fluorescence emission using a CCD sensor. On these images, it is possible to see different areas of the dental surface that fluoresce in green (**sound dental tissue**) and in red (**carious dental tissue**).

• Advantages include motivation for patient and storage of data

VII -Ultrasound Caries Detector

This is a new ultrasonic proximal caries detector that works by transmitting surface ultrasonic waves. The ultrasound caries detector (UCD) device is based on pulse echo method and has software, hardware and transducer as components. A medical grade silicon wedge is positioned in front of probe to yield surface waves on the tooth surface when the transducer comes in contact with the tooth. This detector records specific profiles of ultrasonic echoes obtained from the enamel surface, dentino-enamel junction and pulpo-dentinal junction. Changes in this profile have been described in demineralized lesions, this a substantial difference in the sonic conductivity between sound and demineralized enamel.

VIII-Midwest Caries ID (LED technology)

This technology utilizes a handheld device which emits a soft light emitting diode (LED) between 635 nm and 880 nm and analyzes the reflectance and refraction of the emitted light from the tooth surface, which is captured by fiberoptics and is converted to electrical signals for analysis. The demineralization leads to a change in the LED from green to red with a simultaneous audible signal, which is directly related to the severity of caries lesions.

Advantage is that sensitivity and specificity is higher than that of DIAGNOdent.

Disadvantage is that Midwest Caries ID is not able to differentiate enamel lesions from sound surfaces

IX-CarieScan Pro

It involves the passing of an insensitive level of electrical current through the tooth to identify the presence and location of the decay. The device is indicated for the detection, diagnosis, and monitoring of primary coronal dental caries (occlusal and accessible smooth surfaces), which are not clearly visible to the human eye. During measurement, a green color display indicates sound tooth tissue, while a red color indicates deep caries requiring operative, and a yellow color, which require only preventive care.

Disadvantage is that it cannot be used to assess secondary caries, the integrity of a restoration, dental root caries, and the depth of an excavation within a cavity preparation.

X-Intraoral Television Camera

Through intraoral television camera (IOTV) the dentist can educate the patient and at the same time can improve their own diagnostic expertise as they see magnified oral conditions, which are significantly better than direct vision

• **Advantages** are increased vision and magnification.

• **Disadvantage** is loss of specificity

B-Advances in cavity preparation method

I-Chemomechanical Caries Removal

The chemomechanical method is an effective alternative for caries removal because it brings together atraumatic characteristics and bactericide/bacteriostatic action. The method was created so as that an active ingredient would soften the predegraded collagen of the lesion without pain or undesirable effects to adjacent healthy tissues. The chemomechanical method for caries removal was developed to overcome these limitations.

It is not only more comfortable for the patient but also able to better preserve the healthy tissue. GK-101 was the first chemomechanical agent for caries removal.

Advantages of chemomechanical caries removal are safety, elimination of local anesthesia and bur, lower anxiety, conservation of the sound tissue. it is include **CARIDEX, Carisolv and Papain Gel**

1-CARIDEX

Caridex was developed by CM Habib from a formula made of N-monochloroglycine and amino butyric acid and was called as GK-101E.

Disadvantages of this were expense, additional time consumption and bulky armamentarium

2-CARISOLV

It is a more efficient and effective chemomechanical caries removal system than Caridex.. Despite its effectiveness, Carisolv was not a blockbuster mainly because it required extensive training and customized instruments which increased the cost of the solution. Cariosolv can be used with either hand instruments or Power Drive which is a combined electronic instrument for power-operated, minimally-invasive caries removal.

Indications

• Where the preservation of tooth structure is important

• The removal of root/cervical caries

• The management of coronal caries with cavitation

• The removal of caries at the margins of crowns and bridge abutments

• The completion of tunnel preparations

• Where local anesthesia is contraindicated

• The care of caries in dentally anxious patients, notably needle phobic

• Management of primary carious lesions in deciduous teeth

• Atraumatic restorative technique procedures

• Caries management in patients with special needs

3-PAPAIN GEL

A new type of chemomechanical agent was developed in Brazil in 2003 comprised of papain, chloramines, toluidine blue, salts, thickening vehicle and called as Papain gel.

2-AIR ABRASION (MICROABRASION AND KINETIC CAVITY PREPARATION

The first air abrasion system was introduced in 1951 as Airdent air abrasion unit (SS White). Air abrasion for restoration preparation removes tooth structure using a stream of aluminium oxide particles generated from compressed air or bottled carbon dioxide or nitrogen gas. The abrasive particles strike the tooth with high velocity and remove small amounts of tooth structure. Efficiency of removal is relative to the hardness of the tissue or material being removed and the operating parameters of the air abrasion device. Like any air stream air abrasion can cause subcutaneous emphysema.

Advantages of the air abrasion:

• It is painless

• Local anesthesia is rarely needed

• It works quickly and work quietly without the whine of the all too familiar dental headpiece

• There is no vibration or pressure to cause micro fractures that weaken tooth

• There is no production of heat to damage the dental pulp

• Lesser sound tooth structure is removed.

Clinical Uses

1. Class I, II, III, IV and V cavity preparations

2. Sealants and preventive restorations

3. Repair of composite and porcelain especially margin of veneers

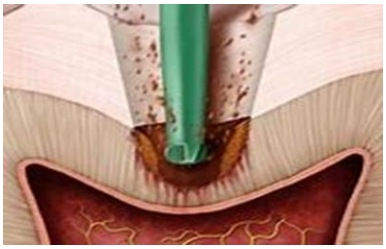
4. Removal of composite and amalgam

3-Laser

One of the main uses of laser in dentistry is the removal of dental caries and preparation of restorative cavities. The use of laser with high power in preparation of cavities presents the advantages of less vibration and pain during procedure and reduced need for local anesthesia. Similarly, using laser in preparation of restorative cavities is accompanied with low risk of damage to adjacent teeth. It also makes the tooth structure more resistant to acid and decay.

As laser acts with a different mechanism to prepare dental cavities, the morphology of laser prepared surfaces is different from that of those prepared by conventional method. Laser prepared permanent and primary tooth dentin reveals non-uniform scaly rough surfaces and opened tubules without formation of smear layer and any evidence of thermal damages.

4-Smart prep bur



The traditional approach using mechanical rotary instruments is not fundamentally conservative because it often results in cavity preparations extending beyond the infected outer carious dentin layer into the noninfected or lightly infected inner carious dentin or into normal dentin. Carbide dental burs are designed to efficiently remove non-decalcified enamel and dentin but do not facilitate the differentiation between carious and normal dentin during cavity preparation.

Polymer burs consist of cutting elements that cut softer dentin efficiently but are unable to cut normal dentin. The cutting blades of Polymer burs will deflect and deform upon encountering normal or partially decalcified dentin, thereby enabling the reduction of cutting efficiency and alteration of the operator's tactile sensation.