Digital Radiography as a Diagnostic Tool in Dentistry
By: Paul F. van der Stelt, DDS, PhD

Digital radiography is currently being used by an increasing number of dental professionals. It is considered to be a well established technology. Numerous scientific studies have been published showing that the diagnostic performance of direct systems (CCD, CMOS) as well as indirect systems (Storage Phosphor Plate based) is equal to, or even better than that of traditional film based imaging. The digital systems are not an experimental technology any more, but could very well replace film to produce images in dental radiology.

The introduction of digital radiology in dentistry was not until about 25 year ago, while analog film has already been in use for more than 100 years. Many dentists have never used digital systems on a routine base during their professional training. These factors may contribute to the fact that dentists sometimes feel insecure when they have to take decisions about the conversion to digital and which system will best meet their requirements.

The questions dentists ask themselves and subsequently their advisors, when they are exploring the possibilities of digital radiography, are most frequently focused on the choice of hardware. Manufacturers often emphasize the large reduction of dose to the patient compared to film based radiography. This seems to suggest that digital radiography is just an electronic replacement of traditional film based imaging. It certainly does not reflect the fact that digital radiographic images have a much more important advantage over film based radiographs; it is possible to optimize the appearance of the image after the exposure has taken place.

Digital Continued on page 8
The AADMRT council has been working with U.C. Berkley Extension to allow us access to the material for training of future dental x-ray techs through the correspondence courses 800A and 800R. These required courses were offered to us in the past, but Berkley discontinued them in 1998 for a number of reasons.

I have been working with the Dean of U.C. Berkley, and the staff of the U.C. Extension classes to re-introduce these courses to us, and they came back with their reply stating that they will not be offering these courses again through their school. They said that the attendance was too low, and that they would find it costly to hire an instructor for the low student count per year. They also mentioned that the material was outdated and needed more information, and Berkeley was not interested in working on this, but they are interested in getting people trained in their field and going out in the work place to make a living.

After many phone meetings with them, and the support and help from Matt Kroona, Berkeley saw the need for this course to be offered again, but they are not willing to offer it themselves. Instead, they presented the AADMRT with the option to buy these courses from them. We (the AADMRT) can own 800A and 800R including the copy write, one paper copy each of 800A and 800R, one electronic copy of 800R, contact information to the printer who has the documents on file, and tests with answers to the tests. The price at which they are offering to sell this material is $5,000.00 for each course with a total cost of $10,000.00.

I have had open discussions with the AADMRT council members (voting and non-voting) to discuss and think about this. Matt Kroona has addressed some concerns from the council concerning these courses. Here are Matt’s comments:

1) Is the material current? I would say that it probably needs some revision but the basics of radiation safety, physics, terminology; anatomy, etc. have not changed much over the years. Some of the California laws have changed but my guess is that the safety test hasn’t changed much either over the years so I expect that it will do a decent job of educating our techs. I would plan on budgeting some additional money for updates, revisions, data input, scanning, etc., certainly not more than $5000.00.

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2) **What will be the cost of this course compared to an LP school?** Berkeley was charging around $700 for this class. LP schools charge between $2,000-$3,000. I would expect we would charge $1,000, bringing our total school cost to $2,000 plus books. At $2,000 per student we would make back all the cost of buying the Berkeley program in probably 1-2 years. I know 5 or 6 labs that want to train techs and would jump on this the minute it becomes available.

3) **Is Matt interested in being the administrator?** It makes complete sense to add this to our existing school, which I currently administer. I expect that in the initial stage, I will work with Craig and others to incorporate the Berkeley portion into ours. Once things are moving smoothly, I think we should consider bringing in an assistant (possibly paid) who would handle paperwork, notebook production and distribution, tests, etc. I don’t see myself stepping away from my duties as administrator in the near future, but I do see it becoming more than I can or want to handle alone.

800's continued on page 18
Do you have a vision for what you want from your lifetime? It is known that successful people do not wander through life accepting what may or may not come their way. Successful people have decided on a direction for themselves, an ultimate driving force. It takes thoughtful hours to achieve this goal, and many have consulted with coaches to help discern what their goals and desires are. One such program is called E-Myth and their web site has some very interesting ideas for business owners and people in general on how to crystalize and obtain their objectives.

I have read that to make the most of our precious time we need to create a “vision” of what is truly important to us; for instance, quality time with family and friends and not necessarily things like status, power, or money. None of these things are genuine driving forces, just interfering distractions. Your core values, beliefs, and desires will shape your vision.

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News and Trends

Articles from AADMRT Republished

The Journal of the American Orthodontic Society (AOS) has asked the AADMRT to place our article written by Dr. William Harrell (summer issue 2003) into the AOS journal. The AOS editor discovered our article on the AADMRT web site, and was very impressed with the information presented by Dr. Harrell.

This is the second time the AOS has requested an article from the AADMRT. The first time was from Dr. James Mah (winter 2002) regarding the use of volume scanning to locate impacted cupids. The article from Dr. Harrell is on current limitations of imaging, and the need for 3D imaging.

The article from Dr. Harrell will go into the AJO in their summer issue. Coincidentally, the AADMRT will have it’s first of several ads placed into this journal beginning in the summer issue. If you would like to receive a copy of the AJO, please contact them at 1-800-448-1601.

Upcoming Meetings

AADMRT 25th Conference
September 23-25, 2004
Marriott Hotel
Park City, Utah
Additional information: www.AADMRT.com

AAOMR Annual Session
November 3-7, 2004
Warwick Hotel
Denver, CO.
Additional information: www.AAOMR.org

Brazilian Association of Oral Radiology
October 20-24, 2004
Summerville Beach Resort
Porto de Galinhas-Perambuco Brazil
Additional information: ccosta@ndata.com.br

Home Study C.E. Available

You can get continuing education credit through this self study course. All courses are evaluated by the American Society Of Radiologic Technologists (ASRT), and are granted Category A Credit. All courses meet the continuing education requirements of the ASRT.

These home study courses come complete with text book and post test. Additional post tests may be ordered for any course for $49.95. Fax service of post tests is available for faster issuance of certificates. All of their home-study courses include free priority mail shipping within the United States.

This course covers essential information on the biological effects of ionizing radiation and radiation protection, helping readers ensure the safe medical use of ionizing radiation. For more information log on to: www.xrayce.com
## News and Trends

### Web Site Upgrades Approved

The board of directors has approved proposed upgrades to [www.AADMRT.com](http://www.AADMRT.com) web site:

1. **Content and Graphics Update**
   The constitution and by-laws, and a membership application will be added.

2. **Upgrades to Advertising System**
   Each web page will display 5 ads instead of the current 3, the advertising administrator will be able to maintain this area, ie. delete and insert ads.

3. **Improved User and Lab Administration Pages**
   The membership chair person will have greater flexibility running this area of the site, changing and reassigning labs, etc.

4. **eCommerce Enhancements**
   An administration page will be added to allow site administrators to change the membership fee and dates for members to pay for membership dues and annual conventions. The current PayPal system will be upgraded so that PayPal will communicate directly with the AADMRT database to record membership activity automatically, emailing updates to appropriate chairs with each transaction.

5. **Quarterly Updates to Newsletter Content**
   The website will be updated quarterly with new articles from the *Currents Newsletter* as each new issue becomes available.

In general, these upgrades have transferred more of the maintenance of the website from the computer programmers to the AADMRT board members. If you have any ideas or suggestions for the Web site, please contact any board member.

### NewTom 3G Debuts

Aperio Services LLC, distributors of the NewTom Volumetric Scanner, is now installing their next generation imager—the NewTom 3G. The 3G builds on the highly successful NewTom 9000 with even lower radiation, faster scan times, 12”/9”/6” fields of view and 12 bit imaging. The 3G is highly computerized allowing for updates and the addition of new features totally through software upgrades. For more information contact: [www.aperioservices.com](http://www.aperioservices.com)

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### AADMRT Spring Seminar 2005

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A conventional radiograph cannot be altered when it has been taken, although the viewing conditions will have some influence on how well the information can be seen. A digital image, on the other hand, can be used as input for a computer program to improve the accessibility of diagnostic information from the radiographic image.

In this article a few examples will be given of methods to improve the diagnostic value of digital radiographs, advantages that are not found in film based imaging. You should be aware that image processing can never add information to the image; it can only make the information more accessible to the user, i.e. the clinician.

The basics of image processing
A digital image consists of a large number of pixels (picture elements), which are arranged in an orderly array of columns and rows. Each pixel is described by three values: the x-coordinate and the y-coordinate which determine the location of the pixel in the image, and a value indicating the shade of gray of that pixel, which in its turn is related to the amount of radiation detected by the sensor at that particular pixel location. The total collection of pixels which form the radiographic image are stored in the computer as numbers. The computer then can be used to apply special mathematical operations on these numbers and the outcome is used to display the processed image on the screen again.

Contrast and density correction
In order to distinguish details in a radiographic image, the contrast has to be good. In general, the exposure settings should be such that the full dynamic range of possible gray values is shown. Only after the exposure has been made will it become clear if one has been successful in achieving this. Sometimes, it turns out that the radiograph has been over- or underexposed to an extent where it is no longer of diagnostic value. This was a reason for a retake when film was used to produce the radiograph. This is different, however, for digital imaging; the range of gray levels of a digital image can be corrected using computer software, and an over- or underexposed image can be changed into an image showing the full range of gray values.

When an image is under- or overexposed, the gray values do not fill the full range of possible gray values. They are compressed into a smaller part of the full range (figure 1). It means that gray values of a particular structure are closer together than usual, which will be perceived as a lack of contrast. By moving the gray values further apart the contrast is increased and the image features can be perceived more easily by the human visual system. Again, no information is added, but the existing information is made available to the clinician more effectively.

Contrast and density optimization can also be used to optimize the image for specific diagnostic tasks. For instance, for caries diagnosis a higher contrast is better. For the assessment of periodontal bone defects a somewhat lower contrast is required. A single digital image can be adjusted for these and other diagnostic tasks without taking additional exposures.

Figure 1: Overexposed image and its histogram of gray values with gray values occupying only part of the full scale (top); same image after contrast stretching and its histogram when gray values are arranged over the full scale (bottom).
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Correction of density and contrast can be done interactively by the user. There is a chance, however, that one keeps changing contrast and brightness until the image seems to show the lesion one expected to see. This approach is therefore somewhat subjective and not reproducible.

**Standardization**
It is better to use the capabilities of computer software to optimize the contrast and density. One possibility is to stretch the gray values equally over the full range of possible gray values (see also figure 1). This can be accomplished in a standardized way by computer software.

Another option is to match the gray value distribution of a wrongly exposed image to the distribution of a correct image of the same patient and the same region. This is also built into some software programs for digital dental radiography. These two approaches make sure that the result is standardized and reproducible. When one wants to do the same operation again later, the result will be exactly the same.

**Measurements**
The location of each individual pixel in a digital image is described exactly by its x- and y-coordinates. Because of the numerical character of this information it is straightforward to perform measurements. These measurements can include lengths or area measurements, but also measurements of angles between two lines.

Continued next page
The measurement of the length of a root canal is conveniently done by taking a radiograph of an endodontic file of known length inserted into the root canal. The beginning and end of the file and the location of the root tip are indicated in the radiographic image. The computer can then easily calculate the magnification of the image from the measured length of the file and subsequently the real length of the root. This is something that can be done on a conventional image as well, but it requires only a few mouse clicks when a digital image is available (figure 2).

**Quality control**

Digital images also make it possible to apply quality control of exposure conditions very easily. For instance, you can display the gray level distribution of an image in a graphical representation in which the gray scale is shown on the x-axis and the frequency of each gray value along the y-axis. When the exposure time was too low when the image was taken, the histogram will be empty at the left side of the histogram. For an overexposed image, the opposite happens: the histogram will move to the left and a certain range of gray values at the right side will be empty. The histogram offers thus a quick and complete overview of the correctness of the exposure settings.

**Subtraction**

Subtraction radiography was first introduced by B. Ziedses des Plantes in 1935. He used film based images of course, but today subtraction radiography has become much more feasible by using digital images.

*Digital continued on page 12*
In subtraction radiography two images are taken with a certain period of time in between. The first image shows the base line. The second image shows what has changed since then. This could be the result of a treatment or the effect of an ongoing pathologic process. Subtraction consists of subtracting the pixel values of the base line image from the pixel values of the second image. When nothing has happened, the result is zero. When bone loss or bone gain has occurred in the meantime, the result will be different from zero. When there is bone gain (less radiolucent, lighter area in the image, higher pixel gray value in the second image) the outcome will be a value above zero. In case of bone loss, the result is the opposite and a value below zero will be the outcome. Because negative values cannot be displayed on the screen, usually an offset of 127 is added to the outcome of the subtraction process. The screen shows a neutral gray in places where nothing has happened. It is darker where material has disappeared and brighter where the amount of tissue or material has increased (figure 3).

Subtraction radiography is a very sensitive method, because it cancels out the anatomical noise. Anatomical noise are the structures that are in the image, but are not influenced by the pathology that has to be detected. The irregular trabecular pattern, for instance, will influence the detectability of bone lesions.

Reconstruction
In order to obtain images that are suitable for subtraction radiography, the two images have to be identical with respect to gray value density distribution and certainly should have the same projection geometry. If one image is taken from a different direction, the subtraction image does not show the pathology but merely the difference due to the different projection directions.

Software is now available to convert the projection geometry of one image into that of the other, thus making subtraction radiography possible, without taking rigid and cumbersome measures to obtain a perfect line up of patient, x-ray machine and sensor system (figure 4). Because of the availability of this software, subtraction radiography is now within reach of every general practitioner and clinician who wants to perform advanced diagnosis of periodontal and other bony lesions.

Figure 3: Subtraction radiography. The image to the right is the result of the subtraction of the second image from the first image. Note the dark area indicating bone loss (red arrow) that was not visible on the original image.

Figure 4: Subtraction radiography after geometric reconstruction of the second image (top right original, bottom right reconstructed) to match images that where taken from slightly different directions. Subtraction is now possible (bottom left).
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**Image processing and legal implications**

Because of the possibilities of image processing, it is often postulated that digital images cannot be used as evidence in a situation where there is a dispute about certain aspects of dental treatment. For an image isolated from the patient database this could be true, but otherwise it is not true. First of all, the computer system keeps track of the creation date of image files and the last date when it has been changed.

The image is also part of a database, where access to the image from outside the database is usually rather complicated. Furthermore, it requires a lot of skills to manipulate an image in such a way that the experts cannot find the transition between pixels belonging to the original image, and pixels that have been manipulated.

A state-of-the-art image database, therefore, should also log who has been accessing the image and when this happened. It goes without saying, that always the original image has to be archived. When an image has been adjusted in terms of brightness and density for instance, still the original image will be in the database, and when the image is retrieved again, the same adjustments will be applied automatically to the displayed image.

**Archiving and retrieval**

An aspect that is still too often overlooked, is the integration of different sensor systems into one environment. Sensor systems are offered with their own software to acquire, process and archive images. However, software from one manufacturer is not suitable to control sensor systems from other manufacturers. Only a few software packages are now on the market that are specially designed to be used in an environment where sensor systems from different manufacturers are used.

Having one integrated software environment has many advantages: users have to be acquainted with only one software interface; all images are stored in a single database; images obtained according to different imaging modalities (intra-oral and panoramic for instance) are shown on one screen; when a sensor system is replaced, the images that are already archived in the database, are still accessible in the same way as the new images; a new sensor system does not require the users to become familiar with new software.

This is an aspect that has to be taken into account in larger clinics, where intra-oral and extra-oral equipment are not by definition from the same vendor. It is certainly an aspect in a clinic where advanced image modalities are used such as CT and tomography. It will also become important for the general practitioner who wants to replace his current sensor, or wants to increase the capabilities by buying another sensor system, which is not necessarily from the same manufacturer.

**Conclusion**

The description of a number of available image processing tools, given in this article, will make it clear how versatile digital x-ray images can be, and suggest the potential for their use as a diagnostic tool in the clinical environment.

A free demo version of a software package for digital radiology in dentistry can be downloaded from [www.radiology.acta.nl](http://www.radiology.acta.nl) (go to “image processing” and then to “download”.)
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The very first *i-CAT* Cone Beam Volumetric Tomography System was installed in our main San Jose office the first week of March, 2004. Our decision to purchase the *i-CAT* was based on several different factors.

Imaging Sciences International, Hatfield, PA, is the manufacturer of this unit and their reputation in our industry was an important consideration. Our previous ten years of experience with the *CommCAT* had demonstrated their level of technical support and commitment to their customers. The *CommCAT* has certainly performed to our expectations and we would expect that same level of performance from the *i-CAT*. We are pleased that the *i-CAT* has indeed performed flawlessly. ISI has always been receptive to suggestions from their customers and continues to do so with this new technology. Significant upgrades have already been implemented. These include reducing the acquisition time from 40 seconds to 20 seconds. A 10 second scan is also available for open TMJ views. The faster 20-second scan also cuts the radiation dose in half. The estimated new dose of about 60 micro Sieverts is comparable to other units on the market.

These shorter scan times, in conjunction with the preferred “patient seated” position, tend to reduce patient movement, which is critical to successful CBVT scanning. This seated positioning for the patient also seems to be well suited for the functional TMJ studies which may include closed, rest and open views. Patient acceptance of this machine has been exceptional. Familiarity with a panoramic unit seems to alleviate any concerns they may have about the study. Patients who have had a panoramic x-ray are immediately put at ease when they realize the similarity with the CT. This may also explain why patient movement has been at a minimum with the *i-CAT*. At the same time they are very impressed with the images. (We make it a point to let the patient view their scan if they express a desire to do so.)

The *i-CAT* incorporates the new 12 bit processing which produces superior grayscale imaging. It was an obvious advantage to obtain this level of technology without having to upgrade at a later date for an additional cost.

*CT Continued on page 19*
Having dental X-rays while pregnant may increase the chance of giving birth to an underweight baby, research suggests. Previous research has suggested a link between medical X-rays and low birth weight babies - but not dental x-rays.

Scientists at the University of Washington believe scrapping dental x-rays for pregnant women could cut low weight births by up to 5%. The research team’s conclusions are published in the Journal of the American Medical Association. A low weight baby was defined as weighing less than 2.5 kg (5lb 8oz). The researchers examined the records of women who received dental treatment between January 1993 and December 2000. Among women who gave birth to underweight babies, 1.9% were exposed to a relatively high (at least 0.4 mGy) cumulative level of radiation from dental X-rays. The same level of exposure was only half as common among women who gave birth to a normal weight baby.

**Increased risk**
Overall, women who were exposed to at least 0.4 mGy of radiation from dental X-rays seemed to be more than three-and-a-half times more likely to give birth to an underweight full-term baby than women who had no dental X-rays at all during pregnancy. Writing in the journal, the researchers, led by Dr Philippe Hujoel, said their work questioned the idea that it was safe to give pregnant women low-dose X-rays as long as they were not targeted at the reproductive organs.

They said that ending the practice of giving pregnant women dental X-rays could potentially cut the prevalence of low weight births by up to 5%. However, they accept, as many women do not know they are pregnant when they go for dental treatment, it would be impossible to ensure that no pregnant women is exposed to radiation in this way. Dr Hujeol said: “We don’t know whether radiation affects neurohormonal mechanisms in the head and neck region, such as thyroid function, or whether factors unrelated to the X-rays are to blame.

Birth Weight Continued on page 19

Image Is Everything

The American Association Of Dental Maxillofacial Radiographic Technicians (AADMRT) provides imaging records for the dental community. Allow one of the AADMRT Labs to take your diagnostic records and improve your professional image. We are independent dental imaging centers that provide the highest image quality at the most reasonable cost. To find a lab near you, please log on to [www.AADMRT.Com](http://www.AADMRT.Com) and type in your zip code under “find a lab”

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*Some services may not be available at all lab locations
4) Will the state approve it? Our school was originally approved with the Berkeley program as ½ of our curriculum. When Berkeley dropped the program, the people from the state suggested that we buy the program from Berkeley. There is no doubt in my mind that the state will approve this. In fact, I am not planning on even asking them. I am planning on adding it to our program as it was approved originally, with us administering it instead of Berkeley. - Matt

In conclusion, we have had many weeks of discussion regarding the 800s, and with the approval of the AADMRT council, I signed and mailed the contract agreement to purchase these courses from Berkley on July 19th. We should be getting the material within the next few weeks, and you will have an update on the progress of this by the fall conference.

Even though this is currently a California issue, it may end up being a great opportunity for the entire AADMRT. We would have a fully accredited school for dental x-ray technician training. We could quite possibly get other states to adopt California’s strict codes for training, and we could become the one and only school nation-wide for dental x-ray technicians, therefore we would be able to offer, “AADMRT certified and trained.”

Here are a few other quotes from your council members regarding the 800s:

“I feel that this is a very unique opportunity for the AADMRT to finally be able to offer a complete course to train dental x-ray technicians. The benefits of the AADMRT offering a fully accredited dental x-ray technician course are huge” - Eric Iwamoto

“What a great opportunity for AADMRT...I vote a definite YES. - Kevin Fox

“If the State of CA approves of this offering, through Berkeley or AADMRT, we would be foolish to let it slip away. AADMRT can then offer it to new trainees and offer a deluxe certification program using 800 A/R and the AADMRT course load. It is worth every penny”. - Kathleen Cox

“I am in complete support of AADMRT purchasing the 800A and 800R programs from Berkeley. Thank you to Craig and Matt and anyone else that is putting forth their time and effort to see us though this possible adventure. - Merry Hampton

“I say “yes” this is going to be such a good thing for the AADMRT. “ - Tracey Saucier

“I see many doors opening for us as an organization that can offer to “out of state” people our dental x-ray extension courses. I just want to insure ourselves that the direction of the state (CA) is to uphold these courses once we are distributing them. I am in favor of purchasing these courses and think that we should get a committee of dedicated people who can help Matt do some legwork. I will be happy to volunteer if I would be of any help.” – Devery Wallace

“I’m in favor of AADMRT buying the courses. It would give the organization not only educational clout in CA but would be valuable in all other states as well. - Duane Perry
Birth Weight Continued from page 17

“The findings are surprising because the amount of radiation pregnant women were exposed to was very low and generally thought to be incapable of inducing observable health effects.”

“The highest dose observed in our study was about the same amount of radiation exposure as flying 16 round-trips from New York to London.” Other studies have shown that different types of diagnostic radiation, such as those used to investigate spine problems, can also be associated with low birth weight.

Findings doubted
Professor Keith Horner, a dental spokesman for the UK Royal College of Radiologists, told BBC News Online he was very surprised by the findings. “I find it very hard to believe that this conclusion is valid because we are talking about radiation doses within the range of normal background radiation,” he said. “It is not generally considered that there is any risk other than a very tiny increased risk of cancer from dental X-rays. “There were reports of lower birth rates among babies born after the Hiroshima nuclear bomb was dropped, but that is a universe away from the sort of doses delivered in dental radiography.” Professor Horner said it was possible that women who delivered low weight babies had general poor health, and therefore were more likely to need dental treatment.cautious about performing dental treatments on pregnant women. “Women must tell their dentist if they are pregnant, or even if they think they may be pregnant.”

His views were echoed by Dr. Jill Meara, deputy director of the National Radiological Protection Board, who told BBC News Online: “It is difficult to think of a mechanism whereby a level of radiation similar to natural variations that we meet all the time could have a noticeable effect.”

However, she said that it was probably best for pregnant women to avoid dental X-rays unless absolutely necessary. A spokesman for the British Dental Association said: “The risk associated with dental X-rays is very small. “Dentists take X-rays only when they deem it to be necessary as part of diagnosis, and most dentists will be more cautious about performing dental treatments on pregnant women. “Women must tell their dentist if they are pregnant or even if they think they may be pregnant.”

CT Continued from page 16

The cost factor was a major consideration in our decision to buy the i-CAT. At $150,000 (further discounts may be available for previous ISI customers) it can be significantly less than other units on the market. Cost of equipment obviously dictates patient cost and the ability to make this technology more affordable should accelerate its acceptance by the dental community.

In conclusion, our decision to purchase the i-CAT was based on ISI’s reputation and support, the relative cost of the machine, the higher level of technology (12 bit Amorphous Silicon Flat Panel Sensor), patient accommodation (seated positioning), short scan times and the promise of technological upgrades (digital cephalometrics & panoramics) in the near future.

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But what else would you expect from the most trusted name in imaging?
**Tainted CCD**

*By: Craig Dial*

**Digital Camera CCD Dirty**

I just purchased a new Fuji S-2 digital camera, and right away we noticed that our images were showing a few black specks (figure 1). We called up the camera distributor and they said that the CCD chip in the camera had some dust particles on it, and that it needed to be cleaned. My first inclination was to return the camera since it was brand new, but I thought I would try and clean the camera according to the distributors request.

They gave me instructions over the phone on the proper cleaning of the CCD inside the camera, so I thought I would share this information with you in case any one else has experienced dust on their CCD, and want to know how to remove it.

Each camera may be set up differently, but the rules apply to all CCD type digital cameras. First, remove the lens and flash attachments, but make sure while doing this that the camera body is pointing downward. Keeping the camera body facing down will help stop dust from entering the body of the camera. Then turn your camera settings to allow for a multi-second exposure (2-3 seconds will be sufficient). This allows the CCD to be exposed for the duration of your predetermined exposure time setting. Next, depress the exposure switch on the camera, and simultaneously, use a camera air blower (or similar air blower like a turkey basting tool), and puff air directly onto the CCD. I was told not to use compressed air like the type in cans used to clean computers, this sometimes has fragments of water that could attach itself to the CCD. Make sure that you continue to keep the camera body in the face down position. Try this several times, and then put your camera back together.

Test your camera by shooting a target on your wall (figure 2), and look for black spots in your photo. You may have to repeat this cleaning procedure several times to get rid of all dust particles on the CCD. This process will usually clear up most digital camera CCD sensors, but if it does not, then you may have to send it in for a professional cleaning.

A professional cleaning may take several weeks, and cost several hundred dollars, so I recommend trying to clean it yourself first. It worked for me!
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2005 Spring Meeting
San Francisco, CA
April 9

2005 Fall Conference
Phoenix, AZ
date: TBA

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