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Work Simplification

The Radio Visiography (RVG): Where Reality Surpasses Radiological Fiction

A Hope That is Becoming Reality

The computer-generated x-ray (Radio Visiography, or RVG) is described in detail in this article by Dr. Francois Duret, one of the foremost proponents of CAD/CAM. His brother, Bernard Duret, and Dr. Clunet collaborated with him in the development of this paper. The article discusses the technique of computer-generated x-ray, a new combination. The size and type of picture are important; no longer is the dentist tied to the size film we conventionally use. Most important is the fact that the radiation dosage is reduced by 80% over present-day techniques.

Dr. Francois Duret, Dr. Bruno Clunet Coste, and Dr. Bernard Duret

Francois Duret is a graduate of the University of Lyon Dental School, France (1973). He holds a master's degree in Physiology, a Ph.D. in Dental Biochemistry, and an Advanced degree in Periodontology; was graduated from Medical School with a Ph.D. in Human Biology; and, in 1983, became a "State Doctor" (Docteur d'Etat), the highest degree in France, awarded for his achievements in fundamental research. In 1986, he was made Officer of the National Order of Merit. In addition to his membership in many professional, scientific, and civic organizations in France, he is also an affiliate member of the American Dental Association. He is Director of the CAD/CAM Laboratory, and Director of Research and Education at the University of Marseilles, France.

Bruno Clunet Coste has been in private practice in Grenoble, France, since 1972. He is a member of several scientific societies, and is known in France as a pioneer in fixed implants.

Bernard Duret is in private practice in Grenoble, France. He received a degree in Physiology in 1968. His main interest is fixed and aesthetic prosthodontics, and he has been interested for the past 10 years in the biocompatibility of fixed implants and periodontics. For the last 4 years, he has been involved in researching new prosthetic materials, and has a known background of development of composite materials.

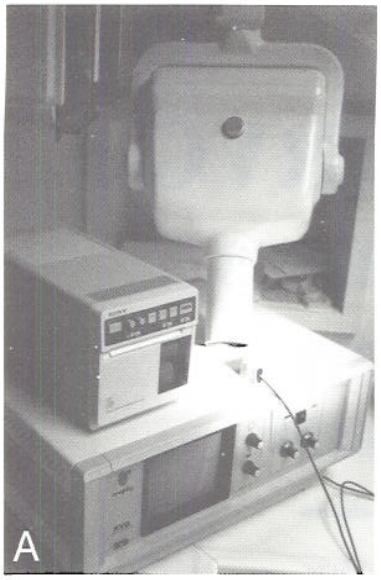
Dr. Francis Mouyens, a dentist from Toulouse in the south of France, has developed a new radiograph system called Radio Visiography (RVG). It consists of a micro-camera placed in the patient's mouth replacing the x-ray film, resulting in an x-ray picture that is instantaneously displayed on a TV screen.

Dr. Mouyens worked alone initially while teaching at the University of Toulouse. Starting in 1984, he associated himself first with several aerospace engineers, and then with the TROPHY Company which today holds the patents on his work.

We are using this system in our office. The system includes four separate components: an intra-oral video camera, a conventional x-ray head, a central processing and display unit, and a printer (Fig. 1A). The operator and patient are seen in relationship to the instrumentation in Figure 1B).

Because French industry has been willing to be involved in the dental field, Dr. Mouyens has been able to take advantage of this synergy to rapidly go from feasibility studies to prototype and, finally, to production. His system was shown for the first time in the United States during the Chicago Mid-Winter Meeting in February of 1988.

The intra-oral camera (Fig. 2) is placed against the teeth to be x-rayed. The CCD receiver (256 × 256 pixels), together with the digitizing boards and eight-bits processor, allows up to 256 levels of grey to be obtained.



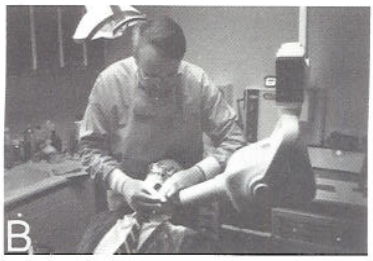


FIG. 1.*A*. Radio visiography system. *B*. Operator and patient seen with instrument.

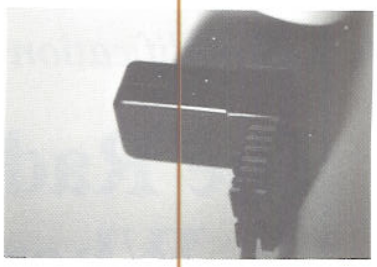


FIG. 2. Intra-oral camera.

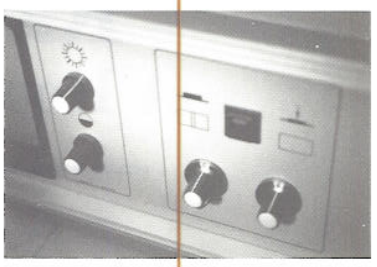


FIG. 3. Dials used to adjust transmission of the picture by the camera.

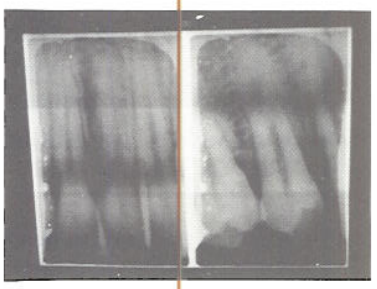


FIG. 4. Picture with contours highlighted.

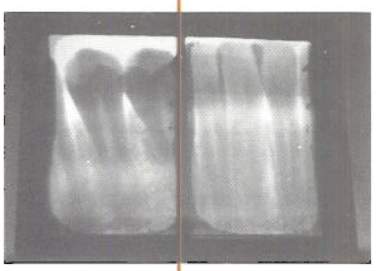


FIG. 5. Reversed picture.

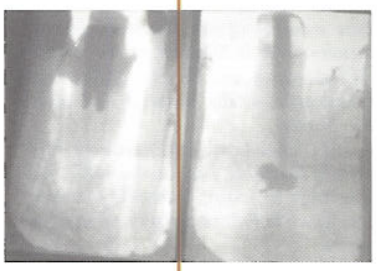


FIG. 6. Picture with brightness adjusted.

The great sensitivity of this microcamera and an efficient control of the x-ray head (IRIS from TROPHY-HEALTHCO) have ***reduced by more than 80% the amount of radiation needed for each picture.***

The camera is connected to a central processor, a digitizer, and a display device. The pictures may be displayed on the monitor or stored on a VCR connected to the processor. In addition, the pictures may also be viewed on a small 15 cm (6″) control screen located on the front panel of the console. It is, of course, necessary to get close to the screen to see the details of the x-ray, but the enlargement of the picture (more than three times) provides an unequalled degree of comfort in viewing and analyzing the picture. A connection to a conventional TV set is also possible as part of this system.

Several dials (Fig. 3) allow the adjustment of the picture transmitted by the camera. With the analog to digital conversion, substantial modifications of the definition and contrast (grey level) are possible. In particular, highlighting the contours or reversing the picture (Figs. 4, 5). Better details may also be obtained by adjusting the brightness (Fig. 6).

The system is extremely simple to use and may be learned by the dentist or assistant in a short period of time. A disposable latex cover is first put over the probe to insure sterility between patients (Figs. 7, 8).

The probe is then placed in the patient's mouth next to the tooth to be studied (Figs. 9, 10).

The x-ray head (IRIS from TROPHY-HEALTHCO in this case) connected to the central processor is then quickly adjusted; a simple pressure allows it to memorize the desired information. By designating the tooth to be studied (Figs. 11) and the desired density (Fig. 12), reference is made to the section of the arch under study.

The x-ray head, here the CCX 708 (70 kw, 8 ma), is wired to a remote control (Fig. 13). A long cone is used. The picture appears instantly on the display screen.

It is possible to display a second picture on the screen and to copy the two images simultaneously on a small optional SONY printer. Contrast and brightness of the paper printing itself is also adjustable (Fig. 14).

As may be seen in Figure 15, full screen zooms (magnified pictures)

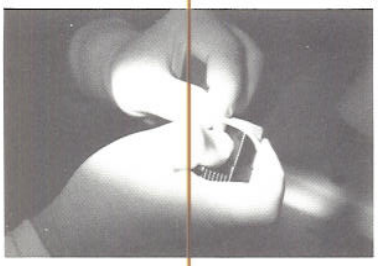


FIG. 7. Disposable latex cover being placed over probe.

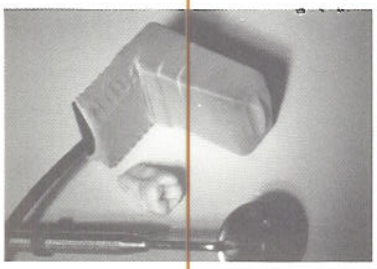


FIG. 8. Probe with disposable latex cover on it.

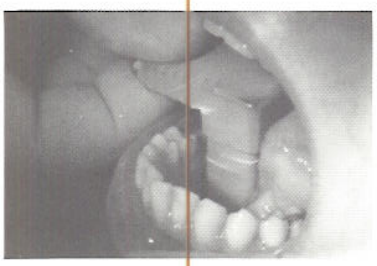


FIG. 9. Probe in patient's mouth.

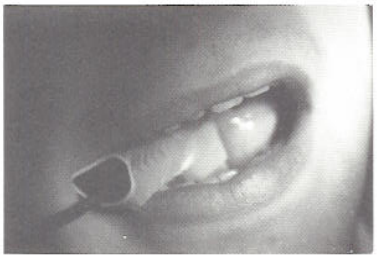


FIG. 10. Probe in patient's mouth.

FIG. 11. Designating the tooth to be studied.

FIG. 12. Designating the desired density.

FIG. 13. The generator wired to a remote control.

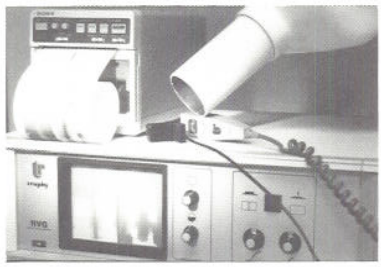


FIG. 14. Two pictures displayed on the screen, and being printed on the optional SONY printer.

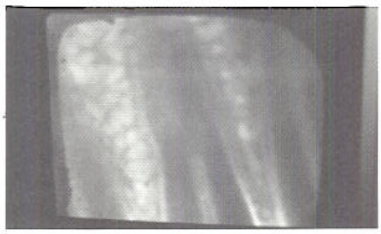


FIG. 15. Full-screen zoom of particular area of interest.

of particular areas of interest may be obtained instantaneously. This is done by positioning the ON/OFF zoom push-button located above the reverse image adjustments on the front panel of the central processor (Fig. 3).

We feel that this system is an extremely important advance in the sophistication and simplification of radiography. Being able to manipulate the contrast and dynamic range of our x-rays will allow us to take full advantage of the power of video digitizing, which is an exploding field today.

The integration of the system in a dental office is extremely simple. Being immediately operational, it should be well received in many American dental offices, which are always on the cutting edge of technology. The product is well designed and meets all our expectations.

We understand intuitively how many possibilities will now be open in the control of root canal treatment, the preparation of prostheses, or the visualization of proximal cavities. The details obtained in the representation of the bone architecture are important for the periodontist.

Although the camera probe may appear a bit bulky, patients are very rarely bothered by it—no more than with a conventional x-ray film. Its small size (10 mm × 22 mm × 14 mm) allows for ease of insertion into the mouth. The narrowness of the probe is a definite advantage, particularly for hard-to-access areas, such as the incisor cuspid area. The rounded edges are less cutting than x-ray films now used. The area on which the patient rests his teeth during the exposure offers considerable stability and comfort to the patient. Pictures may be stored on paper or magnetic tape.

The cost is still relatively high (between $18,000 and $20,000 in France). The system exhibits remarkable performance and the fact that it eliminates about 80% of the radiation dose in each exposure is of extreme importance.

*(**Note:** All photographs are courtesy of Dr. F. Mouyens.)*