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Dentistry and CAD/CAM: Another French Revolution

Dr. Francois Duret, with the development of the laser probe, has now brought to dentistry computer-assisted design/computer-assisted manufacturing.

Arthur G. Williams, D.D.S., F.A.C.D., Editor

At the 40th International Educational Congress of Dental Technology, I believe that I experienced a preview of the future technology of our profession. Dr. Francois Duret, a dentist from France, made his first American presentation of his "Computer-Assisted Design of Dental Restorations" and the "Computer-Assisted Manufacture of Dental Restorations;" the CAD/CAM of Dentistry.

As trite as it may sound, as I sat waiting for the start of the program, I had the opportunity to observe Dr. Duret, a highly animated man. I could not help but compare Dr. Duret, a slight man with metal Ben Franklin glasses, a small mustache, rumpled dark hair, and a cane to aid in walking, with another Frenchman who changed the course of the world's health, Dr. Louis Pasteur. It may be that Duret's impact on the field of dentistry may be as profound as Pasteur's was on medicine.

Duret has developed, over the past 15 years, a technology that combines the computer and milling machine. In brief, the CAD/CAM system allows for the use of a computer to design and a milling to form a crown, inlay, onlay, or denture.

A laser or scanner probe about 10 inches in length and 3/4 of an inch in diameter, developed by Dr. Duret, is directly attached to a computer. There are two techniques that can be used with the laser probe and computer.

When using the first technique, the probe is placed in the patient's mouth and various "pictures" are taken of the area to be treated. In this instance, Duret is about to prepare a lower right second bicuspid for a crown, so the probe is placed over each area, buccal, lingual, lateral, and various angles of the marginal area. "Pictures" are taken and sent to the computer for storage in the memory bank. The tooth is then prepared in the normal manner using diamonds and burs. After the preparation is complete, the probe is reintroduced into the patient's mouth, and a series of "pictures" of the preparation are taken. These pictures are fed into the computer for storage in the memory bank. Duret then operates the computer to design the crown that is to be fabricated by the milling instrument that also is attached to the computer. He makes various entries as he designs the crown, connecting various points so that the crown will be compatible with the environment, leaving a predetermined amount of space for the cementing media.

When using the second technique, the tooth is prepared in the usual manner, and "pictures" are taken of the preparation. The computer is instructed by the dentist as to which tooth is being prepared. In the case of the example which was shown in New York, it is a lower left second bicuspid. The computer has stored in its memory the configurations of 32 adult teeth. It then takes out the one for the lower left second bicuspid and alters this ideal configuration to meet the size of the space in the patient's mouth. If the dentist wishes, he or she can alter the design on the screen. In the example, it is shown that moving the interproximal contact points, as well as the altering of the occlusal surface, could be accomplished.

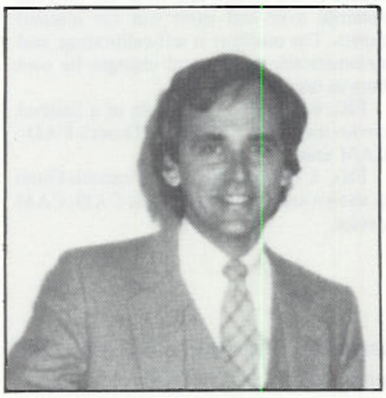
In the example, the tooth is designed as if on an Hanau articulator. If the dentist prefers, the computer can modify the way it designs the restoration so that the results are exactly the same as if it were made on any other type of articulator.

In fact, if the dentist wishes, it is possible to go beyond the static bite relationship which was demonstrated and take a dynamic occlusal record. It is possible for the computer to track the actual movements of the mandible. As such, it can go beyond any present day articulator using the equivalent of an infinitely adjustable articulator.

This ability alone is enough to insure that the restorations being created by the CAD/CAM will transcend the present limits of day-to-day dentistry for the majority of dentists.

After the design was finalized, the computer activated the attached milling machine and, from a solid block of Dicor material, a crown was fashioned. The milling machine changed cutting tools automatically, and fabricated not only the external surface, but the internal surface as well. The fit of the CAD/CAM crowns have a tolerance of 2–20 microns, whereas the average fit of the lost wax technique has a fit tolerance of up to 200 microns. Various materials, including metal, can be used in the milling machine.

The crown preparation, milling machine operation, and insertion that were seen on video tape was completed in 50 minutes from beginning to end. No impression is taken, no temporization, no bite registration, no second visit. It is a fact that I did not see the actual procedure, but, rather, a video tape. I did not test the fit, the margins, or the occlusion, but the impact made by this CAD/CAM procedure was tremendous. Its affect on the field of dentistry and the allied dental laboratory will, I believe, cause a revolution of a monumental nature. It is with this thought in mind that I conducted an interview with Dr. Gerald McLaughlin, American dentist, who has more knowledge and background in CAD/CAM than any other person on the American dental scene.



In September, 1981, Dr. McLaughlin was the first to publish the technique of etched metal bridges in the scientific press. He was also the first to publish the etching recipe against which all others are currently measured (that of Rexillium III and sulfuric acid). He also developed the One Step etch technique, slotted technique, and a number of other innovative procedures.

He has lectured in eight universities and presented over a hundred seminars all over the world.

He is the author of two books, "Questions Patients Most Often Ask Their Doctors," published by Bantam Books, Inc., N.Y., in 1983, and "Direct Bonded Retainers—The Advanced Alternative," published by the J.B. Lippincott Company, Philadelphia, in 1986.

He is a Clinical Instructor, Department of Pediatrics, New York University College of Medicine, since 1982, and a Clinical Assistant Attending, Department of Oral Surgery, Bellevue Hospital, New York University College of Dentistry, since 1985.

He attended New York University College of Dentistry from 1968 to 1972. Dr. McLaughlin has been in private practice since 1975. He is a member of the International Academy of Dental Research, American Academy of Dental Research, and American Dental Association, among numerous other affiliations.

Interview with Dr. Gerald McLaughlin

1) *How long have you been involved with this work?*

I first became involved with computer-assisted dentistry in 1977, when a friend of mine in a computer club described a process which he was developing, known as "solid photography." Using his "solid photography," it was possible to eliminate the casting process of making crowns. To do this, the dentist would prepare a tooth for a restoration and take an impression in the usual manner. Next, a model was poured. A wax-up was then made, and a computer "photograph" was taken of the wax-up. The computer then operated a milling machine to cut a duplicate of the wax pattern from a block of metal. This finished crown would be a "solid photograph" of the original wax-up.

Then in January of 1986, while teaching in France, I met Dr. Duret. After talking for several hours, Dr. Duret asked me to collaborate with him on his CAD/CAM project.

2) *Why does Duret seem to look down on the use of the x-ray to check fit, since it is a basic tool used by dentists at this point to do it?*

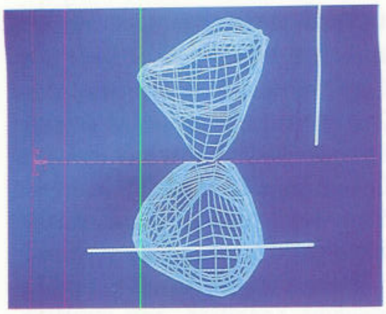
You must remember that the x-ray is simply a sophisticated shadow picture and subject to all the distortions of shadows. Just as your shadow changes length depending on the time of day, so too are there changes in the apparent size of objects being x-rayed. The distance between the film and the tooth, the tube and tooth, and the angle of the central beam all conspire to make for variations in the apparent size and shape of objects being x-rayed. In situations where direct observation is not possible (such as in the mouth), dentists must settle for this type of indirect and relatively inaccurate information for diagnosis. When direct measurement is possible, however, it is far more accurate.

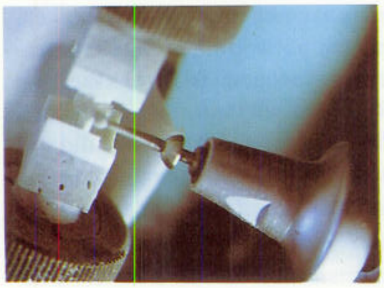
3) A) *What are cost factors of the equipment both for the lab and the dental office? B) How can this system be used when part of it is in the dental office and part of it is in a commercial laboratory?*

A) The final cost factors have not yet been determined. Fortunately, however, there has been a clear pattern over the last 20 years regarding the cost of high technology. Every year the technology gets better, and less expensive. I would expect the costs of this type of equipment to follow the same pattern. What is an equally good question is "what is the value of this equipment"?, and for that question I think only the individual dentist or laboratory can answer.

For the dentist, what would it mean to your practice to be able to have a completed denture that need fewer adjustments completed in, possibly, a single visit? What would be the effect on your practice if your bridges could be completed in a single day? What would be the effect on your practice when patients find out that impressions are no longer necessary at your office?

And for the technician, what would be the effect on your costs if you didn't have to have any pick-ups, but instead had the "impression" and bite that the dentist's optical scanner took sent over the telephone? What would be the effect on your business if you could have crowns, bridges, and dentures delivered less than an hour after the order came in over the telephone?





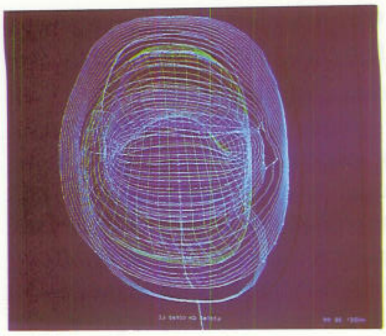


FIG. 1. (*top left*) Two computer views of the suggested tooth design. This can be used as suggested, or modified by the dentist via the keyboard.

FIG. 2. (*top right*) On occlusal view of the suggested design of the crown. Both the internal and external views are superimposed. The operator can determine the exact amount of space which will be left for cement.

FIG. 3. (*left*) The milling machine has begun to carve the crown from a solid block of material. It will first carve out the external aspect of the crown, and then will turn the material over and carve out the internal aspect. The machine is self-calibrating, and automatically selects and changes its own burs as needed.

FIG. 4. (*right*) An example of a finished crown manufactured by Dr. Duret's CAD/CAM unit.

FIG. 5. (*bottom right*) Dr. Francois Duret is shown seated in front of his CAD/CAM device.

These are all very exciting questions, and their answers will only come with time.

B) If a laboratory is working with a dentist that has none of the equipment, it will be possible for the laboratory to simply scan the impressions with the laser probe, and have the computer do the rest. If the dentist invests in a laser probe, computer, and modem, it is possible to eliminate the impressions. In this case, the dentist would scan the teeth with the laser probe, and the data would be sent to the laboratory over the telephone lines. The laboratory would then be able to return the finished restoration that same day.

4) *What is the time needed for dentists and technicians to learn the use of the probe, components, and milling machine?*

It takes about 2 days.

5) *What is the future of the laboratory technician in dentistry? Are their days numbered?*

You have asked a very important question. I think the future of the laboratory technician will continue to be exactly what it has been in the past. In other words, the future will be whatever the laboratory technicians make it to be.

The situation which the technicians face with this marvelous new technology is the same one which dentists have been facing for the last decade.

So, I predict, will be the future of dental technicians. Those who choose to utilize the amazing new power of "laser- and computer-guided dentistry" will surely profit from it, and those dental technicians who choose not to utilize this technology can also have a significant place in dentistry. Not all dentists will own a laser probe. Many practices will simply not be big enough to warrant owning such equipment. Other dentists will prefer to work with the old familiar materials and methods. Many dentists will simply feel more comfortable writing laboratory prescriptions than having a dialogue with a computer.

Those labs who choose to use the new technology will also be able to provide a unique and valuable service. Accuracy can be improved, speed can be enhanced. Further, the decrease in adjustments, remakes, and pick-ups, as well as the use of newer, cheaper materials, should allow for a lowering of fees at the same time. The development of such a "high-tech" laboratory will allow a formidable advantage in the marketplace over the laboratory of today.

I would also confidently predict that the most successful laboratories of all will be the ones who learn to use the new technology to provide faster, more accurate service, but utilize the time that the machinery frees for them to create a close relationship with the dentists they serve. This "high-touch/high-tech" combination will not be for every laboratory. But those laboratories that manage to create such a combination will be the biggest winners of tomorrow.

In short, the introduction of this marvelous technology has simply accelerated the changes that are already taking place in the dental laboratory industry. Everyone knew that this sort of thing was coming. What most technicians have not realized is just how soon and how great the changes will be in tomorrow's laboratory. The introduction of this new technology has made it clear that, just as in the broadway show "Annie," tomorrow is always only a day away.

6) *How will CAD/CAM effect the dentist and his future?*

It is clear to me that CAD/CAM will be an important part of the future of dentistry. It will allow the dentist to provide a faster, more comfortable, and more accurate service for his or her patients. It can also lead to a higher level of satisfaction on the part of those dentists who seek greater control over the fabrication process of dental prosthesis.

The amount of time necessary for certain procedures will diminish dramatically, and this will either allow the dentist to be more productive or have more leisure time. In addition, it may prove cost-effective for dentists to lower the fee for some services, while, at the same time, receiving more profit. This, in turn, may have the effect of increasing the patient demand for certain services.

As CAD/CAM in dentistry continues to develop, machines will be made which are capable of assisting the dentist in preparing teeth for prosthesis, or even taking over the tooth preparation itself. When these units become practicable, the impact of CAD/CAM will be even greater. The role of the dentist will increasingly become one of diagnostician and treatment planner, and less of tooth mechanic.

We must also remember that there surely will be many other developments beside CAD/CAM which will impact on the future of the dentist. And none of these changes will occur overnight. Still, it is clear that change is occurring at an ever-increasing rate, and the future is now closer than ever before. It is a very exciting time.

Future Notes from Dr. Williams

In the April/June, 1987, issue of the JDPA, I will have further information on this exciting new idea. I attended a 2-day meeting sponsored by Dr. Omer Reed that featured Dr. Francois Duret, as well as other men and women representing some of our dental schools that are involved in this type of research. I will bring reports from these universities, and possibly from the Armed Forces that are also working in these areas.

In addition, I have had the opportunity of listening to Dr. Werner Mormann and Dr. Marco Brandestini of Zurich, Switzerland, present a paper, "Chairside Computerized Dentistry." This paper, though similar in approach to Duret's, has significant differences.

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Letters to the Editor

To the Editor:

I am writing because of my concerns with your article about the CAD/CAM revolution.

Although you include a caveat in your letter that the **JDPA** is not a technical journal, it is incumbent upon any publication that takes itself seriously to ensure the technical veracity of the material that it publishes.

The article about the CAD/CAM developments by Dr. Duret makes certain assumptions, and accepts certain statements as true, although they are utterly unproven. Acquiring the image of the moire fringes projected on the teeth is not very difficult, considering the present state of camera technology, but accomplishing some of the other claims seems to violate certain natural laws.

There are three statements made during the presentation and repeated in printed materials that should be more closely examined.

1) Dr. Duret claims accuracy of from ± 2-20 microns.

2) He also states that he uses a camera with 256 × 256 picture elements.

3) He says that he reduces his data points to about 1500 when he constructs his models or the software crashes.

In order to evaluate his statements in relation to a probable situation, let us assume that there is a molar tooth preparation that is 10 mm mesio-distally, 8 mm buccolingually, and 5 mm in occlusal height. For simplicity, let us assume that the measurements of the occlusal table are 1 mm less in m-d and b-l dimension. Thus, we have 63 mm sq of occlusal surface, 47.5 on buccal and lingual, and 37.5 on each interproximal wall, for a total surface of 228 mm sq. In any one view, he must include at least 30% of surface covered in another view to allow the views to be manipulated together. In addition to the tooth involved, he must also image the adjacent teeth. Thus, in any one view, only 70% of the information, maximum, can be allotted to new data; that is, data that does not overlap either another surface or the next tooth for organizing purposes.

If Dr. Duret takes five views per tooth—one per vertical surface and one occlusal—he must record all of one surface with 70% of one frame or 70% of the 256 × 256 pixel array, or an 180 × 180 pixel array. A pixel does not contain any measurement; it is merely the measure of light at that point; thus, in order to detect any line, three pixels are needed—one pixel to record where the line starts (bright), one to record the existence of the line (dark), and one to record the other terminus of the line (bright). Thus, if we wish to resolve a grid of ten lines, 21 pixels would be needed. One hundred and eighty pixels can resolve (or "see") only 90 lines. Thus, the pixels available to "see" the 10 mm margin of the preparation can see only a maximum of nine lines per millimeter, or about one line per 100 microns. Thus, the maximum resolution, the finest detail that the equipment can resolve, by Dr. Duret's own figures, is 100 microns, not 2–20.

What if he did see only this rather crude 10 data points per millimeter? This same resolution (100 data points/mm sq) would mean that, on the preparation alone, there would be 228 × 100, or 22,800, data points—not including information about the adjacent teeth.

If we did measure a data point every 20 microns, or 50 per mm, this would result in 2500 points per mm sq, or 425,000 points for the axial walls alone—no occlusal table or adjacent tooth information.

Dr. Duret stated that he reduces his data to a maximum of 1500 data points, or his software crashes.

To estimate the resolution of his 1500 points, if the 1500 data points are distributed around the preparation vertical walls only ignoring the need to map the adjacent teeth, the result is 1500/170 or 8.8 data points per mm sq, or approx. 3 data points per mm. Thus, his resolution is not 2–20 microns, but perhaps 300 microns.

One last point. The milling machine Dr. Duret uses has a maximum accuracy of ± 20 microns in the XY axes and ± 50 in the Z axis. So, according to the manufacturer's specifications as published in Dr. Duret's papers in French, the margin cannot be reproduced any better than a tolerance of 50 microns. Skillful manipulation of the cutting axes may orient the crown so that the vertical position of the margin is reproduced in the X or Y axis, but the point still remains that the machinery cannot do what is claimed—cut to a tolerance of 2–20 microns.

I have no competence in optics, or the natural laws pertaining to that science, but I have been told by others that moire techniques are limited in resolution by the laws of diffraction.

My area of interest is limited to the actual information that Dr. Duret states that he does get. A simple analogy to topologic mapping of the ground may illustrate my reasoning. A topologic map is accurate only in relation to the number of contour lines per unit of distance; thus, if there are 100 lines/map mile, the resolution is only 52.8 ft (5280/100).

If Dr. Duret projects 50 fringe lines over a 10-mm length of tooth, the maximum resolution is 10/50 or 200 microns. My memory of the slides in the presentation is that he projected more like 12–15 fringe lines. This implies a resolution of even less.

I don't want Dr. Duret to be

wrong, but what we need is a reasoned investigation of his claims and his abilities. By describing the process in great detail and glowing terms implies acceptance and imputes veracity to his work without any real tests. In order to make accurate crowns, a great deal of information is needed. I can't understand how it is produced and how it is used to produce the level of accuracy he claims.

Thank you for your attention.

Lewis Lorton, Col, DC, USA

To the Editor:

I received with pleasure Mister Lorton's letter, by your intermediary, in reply to the article you wrote so kindly for my attention. I know Colonel Lorton from having received several times direct and indirect inquiries regarding our technology from him.

I will begin my reply by agreeing with your position that your journal never had the vocation of being scientific, which has always been clearly specified. By the way, many scientific mistakes, throughout history, can be found, even in scientific journals. You mentioned Pasteur. He needed 40 years to demonstrate that spontaneous generation was a scientific absurdity.

I would like to begin with reclassifying the ideas of the reader. It is true that the chain consists of an acquisition part, a design part, and a manufacturing part. The CAD/CAM phrase is usually applied to the second and third part of the chain. In the third paragraph of the letter, there is obviously a confusion between the acquisition process and the CAD/CAM process. It is true and well recognized that the CAD/soft leads, by inaccuracy of numerous calculations at data manipulation level in the computer, to an inaccuracy of about ± 2 μm. It is also well recognized that micro-milling machines, in certain operating conditions (choice of tools, milling speed and movement, coolant system, temperature stability) enable the dentist to obtain a milling exactitude of about ± 10 μm. (1/100th of a millimeter). Stating that a CAD/CAM Crown has an accuracy of 2–20 μm is really in agreement with the present state of technology.

In reply to point 1, and regarding the accuracy of the relief measurements in a patient's mouth, we never claimed that we have an accuracy of ± 2–20 μm. I illustrated this by projecting a fibroblast at the ending of the presentation in New York.

Regarding point 2, it is not true that we use a 256 × 256 CCD. That was true 2 years ago, but today we use a 512 × 512, as everyone was able to see on my slides at my conference.

Regarding point 3, there is again confusion between the modelization parameters (i.e., polynomial Bezier's functions descipters, for example ...surfaces) describing the relief acquired after interpolation (illustrated by analogy with the Pythagor' theorems during the congress) and the notion of codification in X, Y, and Z of each of the measurement points.

It is true that we manipulate about 1500 curve and surface descripters. These descripters are obtained from a seedplot coming from the image acquisition. Considering the hypothesis of the letter (70% of useful pixels per image and 5 images) this means 900,000 points.

The writer of the abovementioned letter, voluntarily and honestly, places himself for his reasoning on the acquisition accuracy in a specific context.

One can explain that the method presented in his letter is the one I used as an educational example (because it is a very understandable one), but ever since May, 1986, I clearly stated that it was a typical example. We are sure that the Moire's optical method, as it is, does not enable the obtention of good accuracy on small reliefs.

As long as we do not receive an official publication solicitation in an American journal, we do not feel obliged to reveal the exact nature of the process we use.

However, we can specify that it is a process of the Moire family. In a general way, simplistic calculations based on the number of pixels and the number of fringes, always lead to hazardous conclusions about the accuracy of methods. The purely geometric approach, even if educational, must be, in a deep analysis, replaced by a physical approach of the phenomena (wave aspects). This cannot be the topic of a lecture within a dental congress, and there is no reason for explaining it in a journal as specific and serious as the **JDPA**.

The parameters to be considered, at least, in order to estimate the accuracy of such a process are:

1) The nature of projected fringes (triangular, square),

2) Their spectral distribution in space and in time,

3) The frequency (or thread) of these fringes (the method that I gave as example in congress) may allow a theoretical accuracy of about 10 steps in 10. On the contrary, our process allows us to increase this accuracy by a factor of 10.

4) The degradations brought:

- by the optical emission
- by the response of the object
- by the optical return
- by the sensor

The physical parameter to be considered in this context, entitled "modulation transfer function," is very well known by any optical and image acquisition specialist (and is that of which I speak in conferences when I mention the study of the teeth albedo).

5) The number of gray levels affected to the (fringes) modulation range. It is obvious that considering a fringe network like a succession as black and white is equivalent to considering that the numeriza-

tion levels are binary (0.1). As for us, we use an 8 bits numeriszer; that is, 256 gray levels, enabling us to obtain, after cleaning up the image, approximately 100 gray levels on dynamic fringes (contrast).

6) The optical geometric nature (at optical return level and, in particular, coding and return in parallel or diverging beams. This automatically leads to a non-uniform distribution of accuracy in the useful space of shooting. Reporting by analogy between this phenomenon and the zoom lens of a camera).

My team has worked a great deal on the theoretical evaluation. This has enabled us to make simulations of the overall process behavior, and to determine the realistic technological choices in the context of our professions.

After the successive designs of several prototype probes, taking advantage of each step of technological advances, we could check experimentally the accuracy of the theoretical models. With all the usual care for such a measurement, and with an optical probe, the cost of which is compatible with the dental market, we obtain close to the tooth, and in the worst case, an accuracy of approximately ± 20 to 60 μm on an area of no direct use for prosthesis design.

The process, such as it is, operating in my laboratory and with technological means, the cost of which is not compatible with the dental market, gives us an accuracy of ± 5μm.

Regarding the last point, the micro-milling machines that we use today, in May, 1987, give us a tolerance, regarding the modelization, of approximately ± 37 μm for prototypes and about 15 μm on the first series of machines.

We understand that the lack of competence in optics could mislead this reader. The laws of diffraction mentioned in Lorton's letter are some of the elements that should be known, as explained before. We hope to have educated his scientific sagacity through our explanations, which, in fact, we consider to be simplistic.

Regarding the analogy with the topologic mapping, we must warn against the difference between a congress, which is a direct contact, and a written document, the interpretation of which cannot be controlled. It is always good, for educational purposes, and in order to make the phenomenon clear to a non-informed audience, to use analogies between a complex process and a common process, but it is always dangerous to use this method in a study which aims at having a highly scientific nature.

Regarding our reader's doubts, in the next to the last paragraph, I have to point out that it is not due to a lack of competence to understand a phenomenon that one may doubt the results that were presented and obtained following a classical experimental and rigorous protocol in Paris (November 1985), Chamdery, and Luxemburg. Fifteen hundred dentists could check that it was possible to design a crown in the mouth of a patient (this is a public demonstration, and not a publication).

As far as I am concerned, during 15 years, I never doubted à priori the statements of my collegues. I tried to integrate in my reasoning the physical and basic principles they demonstrated and, with the support of specialists, I tried to check the various theories that were announced. I always made sure to check experimentally the theoretical results announced. My triple university training of science, human biology, and dentistry has enabled me, I hope, to improve my scientific mind. This enables me today to be well recognized as one of the founders of a new, innovative movement in prosthetic technology (I feel extremely honored about that).

As a dentist and founder of this movement, and with the confidence of the profession, I feel able to represent the results obtained for our profession by specialized teams (and I will do everything to deserve this confidence).

I would like to greet in particular my spiritual pupils/students in different countries such as Switzerland and the United States of America, who respected the philosophical principles I announced in the beginning of the seventies. One can always criticize the state of a technology at a certain moment in time, but one should be very cautious when discussing, by non-developed reasoning, actions and conceptions based on scientific and fundamental methods. As far as I am concerned, I will always endeavor to respect my profession and my colleagues, and remain very careful in the presentation of results of the work we do. I do not see myself as a man of machines, as the reader's letter could suggest, but as the man of a new professional and scientific philosophy. I must say that my opinion will always remain subjective.

Dr. François Duret

For the information of our readers, the following are Dr. Duret's credentials:

Dr. François Duret graduated from the French School of Dental Medicine in 1973, received his post-graduate degree in Periodontology in 1975, and received his Ph.D. in Dental Biochemistry in 1980. During the same period, he was studying the Sciences, and was graduated in 1969, received his Bachelor's Degree in 1974, and received his Master's Degree in Physiology in 1976. After 1973, he graduated from French Medical School, received his Bachelor's Degree in 1975, his Master's Degree in Human Biochemistry in 1978, his Ph.D. in 1981, and became a Doctor d'Etat (State Doctor) in 1983.

From 1976–1980 Dr. Duret was assistant professor of Biochemistry in the Fundamental Department of the Dental School. Today he is the Director of Duret's Laboratory of CAD/CAM and Director of Research and Teaching in the University of Marseille. He has received First Prize for Research (Paris 1980) and Prestige in Health (Lyon 1986). He was made Officer of National Order of Merit (ONM) by the French Government in November, 1986.

Editor