

# THE Main EVENT

*Groundbreaking gatherings in the oral healthcare arena.*

## Painting the Digital Landscape—

### The UNC ACPEF Digital Dentistry Prosthodontic Forum

*Key opinion leaders* from academia and industry convened in Chapel Hill this January for a national symposium on harnessing emergent digital technologies in prosthodontics. “This conference is really an attempt to gather information for a wide body of knowledgeable individuals,” said Lyndon Cooper, DDS, PhD, MS, Stallings Distinguished Professor of Dentistry and Chairman of Prosthodontics at the host University of North Carolina (UNC) at Chapel Hill School of Dentistry. “I think we have a real opportunity here to increase the awareness of digital technology in dentistry [and] to create friendships or partnerships between the specialty of prosthodontics and the companies that support these digital technologies so that, together, we can fully develop an entire dental profession knowledgeable in the discipline of prosthodontics using these digital technologies.”

The Digital Prosthodontics Technology Conference was co-sponsored by the UNC-Chapel Hill School of Dentistry and the American College of Prosthodontists Education Foundation (ACPEF). Conference co-chairs were Dr. Cooper; Ping Fu, CEO of Geomagic Inc; and David Gratton, DDS, MS, assistant professor of prosthodontics at the University of Iowa College of Dentistry. Approximately 25 prosthodontists and 25 representatives from 15 corporate entities participated, along with representatives of the ACP Board of Directors and members of the ACPEF.

After his convocational remarks, Dr. Cooper called on Scott Root, an ACPEF board member and CEO of Astra Tech, Inc, to introduce the conference. “I’m by no means a technology expert at all,” Root demurred. “On the other hand, being part

of our world today it’s very easy to see that technology is very much changing what we all do and how we deal with the world around us. Think of something as simple as a GPS system in a car and the fact that maps really aren’t much of a factor in our direction finding. Think of handhelds and BlackBerries and how they have shifted the way we communicate. You can go on and on down that list of the evolution of where technology is taking us. Bringing it specifically to dentistry and then prosthodontics, there’s no doubt that there’s a lot of change going on in digital dentistry and its role in prosthodontics. I think to have the prosthodontic leaders here and also having industry together is a great idea because industry plays a role in developing technology and dentistry uses the technology, and having leadership from prosthodontics helping to assess what’s good and what’s bad out of all of that technology is a very important mix.

“I commend the ACP for having this meeting and bringing these groups of people together. It’s important that we in industry play our role in helping to support [the ACP]. I encourage everyone to step up and go arm-in-arm with our colleagues as the ACP continues to define where dentistry is going.”

#### THE DIGITAL REVOLUTION COMES TO DENTISTRY

Following the conference charge by Dr. Gratton, Ms. Fu presented a brief history of digital technology, tracing her experiences in taking digital imaging to the “next level” of 3-D modeling. “If we can make 3-D shapes digital very easily, almost like taking a photograph, then how things are being designed and manufactured and

delivered will completely change, and that will really change our lives,” she said. She went on to discuss the advent of this technology and its use by NASA in reviving the shuttle program in the wake of the Columbia disaster, as well as its use in the medical arena in the Visible Human Project—and finally its initiation into dentistry. All of these examples, she explained, are clear demonstrations that the 3-D digital technology being offered for dentistry is proven technology that is “very well established” through its use in other fields before being “propagated into dentistry.” In addition, “3-D scanners and CBCT have advanced to where it is cost effective to manufacture and design individualized dental devices. Software is now simple enough to be used by non-technical operators, and automated fabrication systems with new medical-grade materials are production-friendly and efficient,” she said. The assembly of key opinion leaders and industry representatives affirmed to colleagues that rapid advances have positioned new technology to prosthodontists for rapid deployment.

#### PICTURE THIS...

Ms. Fu then passed the baton to Len Chamberlain of Geomagic Inc, who embarked on an entertaining thought-experiment in which he described a prosthodontic single-implant, full-crown procedure in the year 2015. “We’ll begin by taking an intraoral scan. Part of my intraoral scan has a calibrated spectrophotometer, so I get color, I get gloss information, as well as geometry. I also take a CBCT. If necessary, the damaged tooth is removed.

“Now, I have a design department, a planning department, a fabrication department, and a surgeon. In the design department, we take that intraoral scan data and start fabricating the top of the tooth, the occlusal surface, everything above the gingival. Not only am I going to fabricate the geometry, I’m going to do the color and the staining on screen. Basically I can paint it to match the neighboring teeth.

“In my planning department they are going to take that cone beam data and they are going to determine the optimal size and location, and in my particular facility, we are going to fabricate it. I’m all about efficiency; I don’t want to cut material and have waste. I want to build

material and reuse everything else. At the end of this particular procedure, everything that I have built is going to go into the patient’s mouth.

“Now, we’ve got the plan material so we’re going to go straight into placing the implant [and] we’re not going to use a drill guide, we’re going to go straight to an automated flapless procedure with a robotic drill. The robot is what gives repeatability to the procedure and eliminates the need for a disposable drill guide,” he explained.

“The robotic drill is going to use a combined data set—CT and surface scan data—to locate the implant. Once the implant has been placed, we’re going to take an intraoral scan with a locating pen and then have a 25-minute rest period. The reason we’ve got 25 minutes is because we can’t fabricate everything we need instantaneously. For whatever reason, I can imagine infinitely strong materials, but I can’t imagine a rapid prototyping process that I can get done in under 25 minutes,” he said.

“Now that I’ve got my implant placed and I’ve taken that scan,” Chamberlain continued, “I’ve got some idea of what the tissue is going to do, so I can now design from the implant to the gingival margin and merge that with the design that I’ve already started. I can now fabricate a complete restoration.”

Once the restoration is fabricated and installed, “we’re going to take an intraoral scan with the restoration in place. So I’ve got a full-blown restoration design that’s got neighboring teeth and contour crown information, if I’ve done this well. From the follow-up scan, I can make adjustments such that the crown as placed is exactly as I intended in the design and is in perfect occlusion.

“I put a timeline together. I can do the seatings, including the 25-minute break, in 100 minutes. It’s a high-tech, team-based approach with repeatable results.

“I was originally thinking about software when I put this together and what sort of things needed to be accounted for in the software,” Chamberlain said. “Restoration design, implant planning either using cone beam or 3-D scan data with a panograph superimposed, registration of the cone beam and surface data, automatic feature detection for locating the implant, and merging super- and sub-gingival design components of the restoration.

“So as it turns out, I don’t have a very good imagination, because everything [I described] relative to the software we have already done. So by 2015, I’m not waiting for [software technology]” to make this scenario happen, he said. “I need the



John Williams, dean of the UNC-Chapel Hill Dental School, addresses the conference. Image courtesy of Ramona Hutton-Howe.



Dr. Cooper speaking to the participants. Image courtesy of Ramona Hutton-Howe.

## Platform Presentation Participants

### Session 1: Diagnostic Imaging

- Sirona Dental System, LLC; Charlotte, NC
- Imaging Sciences International; Hatfield, PA
- Vident; Brea, CA
- IMTEC Dental Implants; Ardmore, OK

### Session 2: Intraoral Data Capture

- Sirona Dental Systems
- 3M ESPE; St. Paul, MN
- D4D Technologies; Richardson, TX
- Cadent; Carlstadt, NJ
- Ivoclar Vivadent; Amherst, NY

### Session 3: Custom Implant Abutments/Prostheses

- Biomet 3i; Palm Beach Gardens, FL
- KaVo Dental; Lake Zurich, IL
- Straumann/Etkon; Andover, MA
- Astra Tech; Waltham, MA
- Nobel Biocare; Yorba Linda, CA

### Session 4: Prosthesis Fabrication

- 3M ESPE
- DeguDent GmbH; Hanau, Germany
- KaVo Dental
- Great Lakes Orthodontics; Tonawanda, NY
- 3D Systems; Rock Hill, SC

### Session 5: Software/Treatment Planning

- Geomagic Inc; Research Triangle Park, NC
- Materialise; Glen Burnie, MD
- Keystone; Burlington, MA

infinite material strength and I need the robot and I'm done."

## BACK TO THE FUTURE

Following Mr. Chamberlain's presentation, John Williams, DMD, MBA, dean of the University of North Carolina's School of Dentistry, took the podium and commented on the importance of training dental students in techniques involving this technology. "Those of you in the academic world teach at the graduate level and focus a lot of attention at the graduate level. I come at things from a perspective of a general practitioner," he said, "and bear in mind that 75% of our graduates in the United States do involve themselves in general practice. People say that these are techniques and procedures that are well beyond the hands of the undergraduates—I don't necessarily believe that. Len [Chamberlain's] presentation reaffirms some of my thinking in terms of how we can really harness the technology and have a good understanding in terms of how we would approach that for patient care.

"From the dean's perspective, I look for leadership. I look for leadership in the

college. I look for leadership from industry colleagues and certainly welcome each of you here to engage in what I'm sure will be a very productive day and a half."

The remainder of the 2-day conference was indeed a productive—and often frenetic—exploration devoted to illuminating exactly how near or far technology is from making Mr. Chamberlain's thought-experiment—or some parallel scenario—reality. Presentations were divided into five main arenas: Diagnostic Imaging, Intraoral Data Capture, Custom Implant Abutments/Prostheses, Prosthesis Fabrication, and Software/Treatment Planning. Each session included brief presentations by representatives from companies paving the way forward and responses by participating prosthodontists, and was complemented by vigorous discussions between the audience and presenters.

The Diagnostic Imaging session featured Christopher Scharff, vice president of sales at Imaging Sciences International, discussing the paradigm shift towards digital dentistry, the importance of controlling surgery and making it predictable, and the utility of the i-CAT technology.

Sjon Grobee followed with a presentation on IMTEC's Illuma and its advances in CT imaging technology.

John Smithson, marketing director for imaging at Sirona Dental System, LLC, then discussed the usefulness of digital technology and Sirona's contributions, including virtual implant placement.

Dr. Martin Mendelson, director of professional development at Vident, concluded the presentations with a report on "how color relates to digital prosthodontics," illuminating how the Vita 3D Master shade guide is in fact digitally derived, and finishing up with a discussion of the company's contributions to CAD/CAM technology via Vita blocks. Data acquisition by scanning technology was represented to the group as an established technology that continues to improve safety (dose), reliability (data), and usefulness (interface designs). Integrating data acquisition technology into prosthodontic treatment planning was viewed as an important step forward among the participating clinicians.

The Intraoral Data Capture session led off with Harold Auten, a marketing and sales manager from Sirona, discussing the history, significance, and track record of the Cerec system.

Dr. Berthold Reusch, director of clinical and scientific affairs at Brontes Technologies, illuminated 3M Brontus' LAVA chairside oral scanner and addressed the future of oral scanning, and Gary Severance spoke for D4D Technologies and their E4D system, with its powder-free, laser-based technology.

Simon Ghosh, representing Cadent, discussed the iTero™ digital impression system, and Dr. Thomas Hill, manager of the Applied Testing Center at Ivoclar Vivadent, rounded out the session with his presentation on materials for digital systems,

specifically the Empress® and new IPS e.max products.

In the next session, the Custom Implant Abutments/Prostheses discussion was initiated by Matt Powell, director of technical marketing at Biomet 3i, who discussed the company's Architect PSR (patient-specific restorations) products, including the Encode Complete restorative system and CAD Structure Mill Bars and Frameworks. Michael Eidenschink, a business unit director (high-tech) from KaVo followed with a discussion of the EVEREST system and KaVo's marketing/distribution agreement with Neoss Limited. Using the NeoLink adapter, the EVEREST system can manufacture custom implant abutments for 85% of the available ceramic and titanium implant systems.

Jane Ratcliff, manager of strategic accounts for the Etkon division of Straumann, spoke about the company's office/laboratory scanning systems and the planned introduction of a new 8.5-ton milling machine for custom abutments in the Arlington, Texas, milling center, which will eliminate the need to process abutments overseas.

Julian Osario discussed Astra Tech's Atlantis™ system, and John Van Dyck, NobelEsthetics™ regional specialist, concluded with a talk on Nobel Biocare's Procera™ custom abutments and the NobelGuide™ system.

The fourth session, on Prosthetic Fabrication, began with a talk from Peter Golden, professional relations manager at 3M ESPE, on the Lava system. The session continued with Lothar Völkl, director of development and application technology at DeguDent GmbH, discussing DeguDent's advances, such as Compartus Titanium, followed by Jeff Thibadeau, director of education for KaVo Dental, presenting more information on the EVEREST System.

Mark Lauren, director of research and development at Great Lakes Orthodontics, discussed the company's occlusal splint technology and its impact on orthodontics and interdisciplinary dentistry. Lee Dockstader, vice president and general manager of the stereolithography products business unit of 3D Systems, Inc, closed the presentations with a description of their InVision™ 3-D Modelers and V-Flash technology.

This session was of great interest to the prosthodontists who often focus intensely on the methods and materials involved in making implant abutments, crowns, and fixed partial dentures. Later in the day, several prosthodontic leaders suggested that the justified heightened expectations and our enthusiastic imagination should be balanced with careful evaluation and appropriate education.

The final session was on Software and Treatment Planning. Len Chamberlain of Geomagic returned to the podium to discuss the Geomagic Studio Version 10, a CAD package optimized for the organic flow of information. Carole Brown, a

product manager at Materialise Dental, followed with her presentation on SimPlant technology—SimPlant 11, the current model, and SimPlant 12, the impending model with a SurgiGuide preview and design wizards—for virtual treatment planning, and the SimPlant Academy educational program.

Dr. David Altobelli, chief medical officer for Keystone Dental, concluded with a discussion of his company's platform and looked to the future, including technology to integrate jaw movements and force contacts into digital modeling. The possibility of creating the virtual patient for treatment planning and restorative procedures may be a not-so-distant reality.

After the sessions, break-out groups debated four elements requisite to moving the relationship between industry and dentistry forward: What can the ACP do to promote technology transfer in dental schools and private practice? What will the working model be between laboratories, dentists, and companies? What research needs should be promoted? What is the role of digital diagnostics in prosthodontics and how should it be integrated? An overwhelming majority of the participants from both industry and prosthodontics believe that organized prosthodontics has a particularly valued role in helping the specialty bring new technology to the discipline of prosthodontics. Several individuals who serve on the ACP board of directors remarked that they were pleased to see industrial partners suggesting strategies to aid clinicians in adopting new technologies that are wholly aligned with the current vision of the ACP.

## CONCLUSION

"It's not the scan, it's the plan," said Scott Ganz, DDS, a 20-year pioneer of digital technology in prosthodontics. "You come from the perspective of the ACP and prosthodontists—who better to be planning the cases than prosthodontists, who know the end result and the result that we want to achieve both functionally and esthetically? I think we can take a leadership role in this area by being able to educate the world on how to plan cases better. These tools that we've just seen presented can allow us to be able to plan the cases to the best of the technology that exists today, without question."

"Integrating digital informatics, imaging technology, rapid prototyping, and novel client materials will provide a new level of clinical excellence accessible to a wide array of dentists worldwide," agreed Dr. Cooper. Reflecting on the value of the Digital Prosthodontics Technology Conference, he concluded, "Prosthodontists are innovation leaders and have formed new partnerships in the rapidly changing technology industry. Together we will bring clinical improvements to the dental community by careful testing and evaluation, documentation and, especially, education."