Better together

‘The whole is greater than the sum of its parts.’ ~Aristotle

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Synergy has been described as two or more things functioning together to produce a result not obtainable independently. On a daily basis, we find examples of items that when combined provide synergy or a better effect than either could alone, whether in the edible world (e.g., peanut butter and chocolate in a Reese’s Peanut Butter Cup, see also the “Perfect pairing” article on page 38) in the superhero field (e.g., Batman and Robin) or now, in dentistry (cone beam and digital impressions).

The combining of virtual patient information captured via different sources but then combined, serves to provide even more information and capabilities than either source alone. Specifically, every practitioner can experience that by combining 3-D cone-beam information (DICOM data) and intraoral scanning images; diagnostics and implant and restorative planning can be completed with more proficiency, efficiency and confidence than ever before.

In the world of digital impressions and chairside design, there are only two systems currently on the market that capture the intraoral scan and are immediately able to generate (and fabricate/mill if desired) a proposed restorative solution (design the restoration), the CEREC system (Sirona Dental Systems) and the E4D Dentist System (D4D Technologies) [Fig. 2].

Both of these systems also now offer the ability to combine the proposed and planned restorative information (information above the tissue) with the surgical information and planned implant therapy (information below the tissue) to complete and demonstrate the planned treatment before initiating any treatment.

The CEREC system completes this solution by exporting a fixed restorative scan/file into GALAXIS (implant planning software) where it is joined with the DICOM data from the Galileo’s cone-beam scan. Most often this combining of data files occurs on the computer associated with the Galileo/GALAXIS system, typically away from the clinical operatory.

The E4D System (D4D Technologies) has taken a different and more open approach and imports the DICOM data from one of several cone-beam systems (i-CAT (ISI), Gendex GXDP-700 (Gendex), OP-300 (Instrumentarium) or Scanora (Soredex) into the chairside restorative system E4D Dentist. Proprietary software called E4D Compass™ (D4D Technologies) can then link with an “active” restorative file and design. E4D Compass software that combines the data of the intraoral condition with that of the corresponding DICOM data chairside — all right in the operatory or wherever the mobile cart is.

The E4D Compass software provides restoratively driven implant therapy planning in an easy-to-use and intuitive format: E4D Compass is an acronym for Cone Beam Pairing Software Solution.

While survey estimates vary greatly on the percentage of general dental practitioners who are actually placing their own implants,1-3 it is safe to say and readily acknowledged that nearly all general practitioners and their teams discuss and offer implant therapy as an option in treatment plans dealing with edentulous areas.

In fact, there continues to be a high annual growth rate predicted, not only for implants and their accompanying parts and procedures4, but also for single crown restorations — with a much slower growth in fixed partial restorations (bridges).5

In fact, according to the ADA Key Facts, full coverage restoration is the third most common procedure a general practice completes behind prophylaxis and oral exams.6 So the future direction is clear: more single tooth implants and more single tooth restorations.
Software solutions

The software that typically accompanies or is suggested for use with the actual cone-beam system (e.g., Invivo (Anatomage), Cliniview (Instrumentarium), SimPlant (Materialise) is typically feature-rich with levels upon levels of diagnostic fields, measurement capabilities and visual markers.

The intent of the E4D Compass software is to combine the accuracy and the simplicity associated with its chairside restorative counterpart (E4D DentaLogic) in a format understood and valuable to the restorative clinician educating (and selling) their patients on the option of implant therapy.

But most important is the ability to plan the restorative placement first, as the ideal, providing guidelines for the surgical team — whether it is the practice itself or if the procedure is referred out.

There are numerous associated companies and dental laboratories that provide support, cone-beam readings and associated surgical guides (e.g., 3-D Diagnostics, 360i imaging) in order for the final treatment to be completed, but E4D Compass provides the restorative clinician, the capability to preliminarily plan, educate, communicate and then collaborate through the restorative cycle — providing a clear concise and confident plan for the surgical team/referral.

The planning process

Patients don’t regularly enter a practice with a demand for placement of a dental implant, instead, more commonly, the complaint is lost function or the presence of a food trap in an edentulous area. It is up to the dental professional to gather the relevant data and then suggest the options for treatment, based on a number of clinical parameters that could include one or more of the following: fixed partial bridge, removable partial bridge (partial), implant therapy, orthodontic movement or nothing at all.

Only when the restorative clinician has more information via study models (either stone or virtual), 2-D or 3-D data (X-rays or cone-beam scan), clinical observation and functional requirements can he/she properly recommend or treatment plan the functional restorative options.

Having a digital scanner that can proceed directly to a restorative outcome (i.e., Function First) allows the clinician or clinical team to scan the edentulous (Fig. 3) and functional area and then design the ideal restoration, regardless of the manner that will eventually hold it in place (Fig. 4).

Another consideration is if the digital scanner selected uses technology that doesn’t require a contrast agent (i.e., powders or sprays) scans of the oral environment can take place at any stage pre- or post-surgical without the concern of residual powder or disturbance of the healing process. The E4D Dentist system uses a laser to capture the 3-D environment whether soft tissue, hard tissue, impressions or models and without the use of a contrast agent.

By using digital scanning one is able to show the patient immediately the restorative plan, which means the process can continue through to the next steps more smoothly, which if implant therapy is being considered, could include a work authorization for a cone-beam scan.

Once you have a compatible cone-beam scan, (iCAT, Gendex, Instrumentarium, Soredex) you can simply import the cone beam scan and through proprietary visualization within the E4D Compass software you can align the two data sets (Fig. 5). Then the treatment planning and education can begin.

After confirming the proper data sets by seeing the intraoral scan data and the cone-beam data, nerve identification can begin if it is a mandibular case. With a click of a mouse, data sets are moved to arch form and visualize the area of interest. Once the mandibular canal in the surgical area is identified, and the areas can be viewed in all planes, the nerve is visually depicted similarly to the method use to draw the margin on a restoration, clicking the mouse and following the line.

Once the nerve has been drawn, it can be enlarged to provide a visual safety factor, and even carried out through the mental foramen (Fig. 6).
Fig. 6. Drawing of mandibular nerve with the E4D Compass Software.

Fig. 7. Final screen with abutment, bone density, implant and restoration.

Fig. 8. Report providing details of the planned treatment.

**Alignment of the data sets**

Unlike other software alignment procedures, E4D Compass allows the operator full control—although initially the alignment is proposed along the best possible case, with E4D Compass the operator has visual clues and complete control to adjust the alignment of the two data sets. Again, intuitive controls and visualization within E4D Compass make this an easy task.

Once the nerve(s) are marked and the models are aligned, the clinician can go through placement procedures of the preferred implant (manufacturer, type and size), location as well as the measurement details of a standard abutment selection, including angled abutments. The abutment view provides the clinical team the ability to adjust several parameters of the abutment, the wall height, the collar radius, collar height and even an angled parameter showing 5, 10 and 15 degrees of angulation.

Each pane of the E4D Compass software can be expanded to full view for better visualization or realization. The density of the surrounding bone (in contact with the implant and/or within 1 to 2 mm of the implant) is depicted visually in a color-coded scale matched to Hounsfield units for representation of proper bone quality (Fig. 7).

All of this provides the clinician and the patient with confidence, more information and a better case acceptance experience knowing that the procedure has been planned and correctly predicted prior to any surgical or restorative procedure or expense (other than diagnostic) has been completed.

Once the general plan has been approved, E4D Compass provides an easy method to communicate the intended plan to the surgical team. Clicking on the report icon will produce an html file consisting of the images of the last screen, the details of the implant selected as well as the outline of the intended restorative solution. This can all aid the surgical team in placing the implant according to the intended restorative position.

As always, the surgical guidelines/quality of the bone may dictate the final location and placement, however, providing a blueprint of sorts through the use of planning software will certainly set forth an ideal target area and eliminate restorative complications and surprises (as well as minimize expenses) should it be followed (Fig. 8).

Synergy amongst various dental technologies will continue to improve the communication between dental professionals and patients as well as the teamwork and collaboration involved when providing excellence in dentistry.

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**References**

1) Dental Implants facts and figures; American Academy of Implant Dentistry (10 percent).
2) The Wealthy Dentist Survey (53 percent) www.thewealthydentist.com
4) Millennium research, 2010.
5) DATA research 2010.
6) ADA Key Dental Facts.