THE CUTTING EDGE

(Editor's Note: This quarterly column is compiled by JCO Technology Editor Ronald Redmond. To help keep our readers on The Cutting Edge, Dr. Redmond will spotlight a particular area of orthodontic technology every three months. Your suggestions for future subjects or authors are welcome.)

Age-Old Questions

Which works best? An .018" slot or an .022" slot? A standard edgewise system or the latest available prescription? Which is more cost-effective? Should we employ the same appliances in all circumstances or opt for a case-by-case selection?

Until recently, most of these age-old orthodontic questions have been answered subjectively, based on trial and error. Now, however, a technological advancement promises to bring a more objective perspective to our unsettled dilemmas.

The OrthoCAD Bracket Placement System* includes dedicated hardware and software platforms, neatly packed into a mobile cart or a stationary unit. At the forefront of the system stands a pen-sized wand, consisting of a tip, a miniature video camera, and LEDs (Fig. 1). Connected to a PC through a control box, the wand has three main functions:

1. Steering the appliance to the targeted location on the tooth (multiple tips are available for anterior and posterior positioning as well as for different bracket types).
2. Transmitting real-time video images, using the video camera and white LEDs.
3. Temporarily pasting the appliance to the tooth once the target has been acquired.

The OrthoCAD software has three major components:

1. The 3D Browser, where digital models can be viewed and diagnosed.
2. The Virtual Set-Up, used to evaluate any number of post-treatment occlusion scenarios through virtual positioning of orthodontic appliances.
3. The Bracket Placement tool, which uses military-style pattern-recognition algorithms to ensure precise bonding.

Fig. 1 OrthoCAD bracket placement wand.

*Trademark of Cadent, 640 Gotham Parkway, Carlstadt, NJ 07072.

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Fig. 2 Fine-tuning virtual setup.

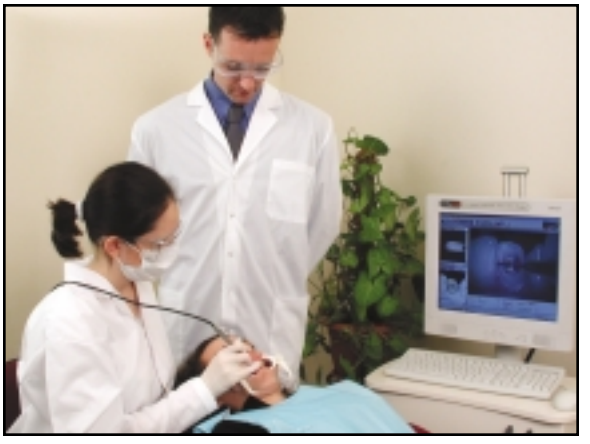

Fig. 3 Monitoring bracket placement with wand and video camera.

Bonding Procedure

As a first step, the OrthoCAD service center transmits to the office a three-dimensional digital setup, based on the clinician's prescribed treatment plan. The orthodontist then reviews the case and, if necessary, adjusts the setup to establish the best possible occlusion. Intuitive software tools generate additional setup options for comparison with the original scenario (Fig. 2). No further communication with the service center is required.

Each setup includes the precise 3D coordinates needed for bracket placement. When a tooth is selected, the user pushes the wand tip into the bracket slot while the video camera projects real-time images on a chairside high-definition monitor (Fig. 3). The software simultaneously transforms the 3D coordinates into a bracket-shaped target that is overlaid on the image of the tooth.

Next, the operator uses the wand to move the bracket into the target, guided by the information on the monitor (Fig. 4). When the video image transmitted by the wand and the bracket-shaped target are exactly overlaid, an audiovisual confirmation is provided, and the bracket is temporarily attached to the tooth using a low-frequency light (Fig. 5).

The same process can be used for indirect bonding by transferring the setup information to a plaster cast for preparation of the indirect trays. This can help realize one of the key benefits of indirect bonding: consistent, accurate bracket placement.[1]

A New Perspective

Precise bracket positioning expresses the full potential of the appliance and thus yields better treatment outcomes with shorter treatment times. Another interesting advantage of the OrthoCAD system is the new perspective offered by the software on the relationship between the appliances and the occlusal outcome. The setup generator contains a library of the most widely used brackets, tubes, and wires—all in a virtual format. This allows the orthodontist not only to compare multiple treatment scenarios—such as two-bicuspid vs. four-bicuspid extractions—but also to examine the consequences of using an .019" × .019" finishing wire instead of .016" × .016", or of employing that popular new bracket prescription.

This may sound like overkill for most cases, but in my office we can attest that the interaction with the software has helped us avoid some major pitfalls in what seemed to be classic treatment plans. To our astonishment, we discovered that it was in those seemingly straightfoward

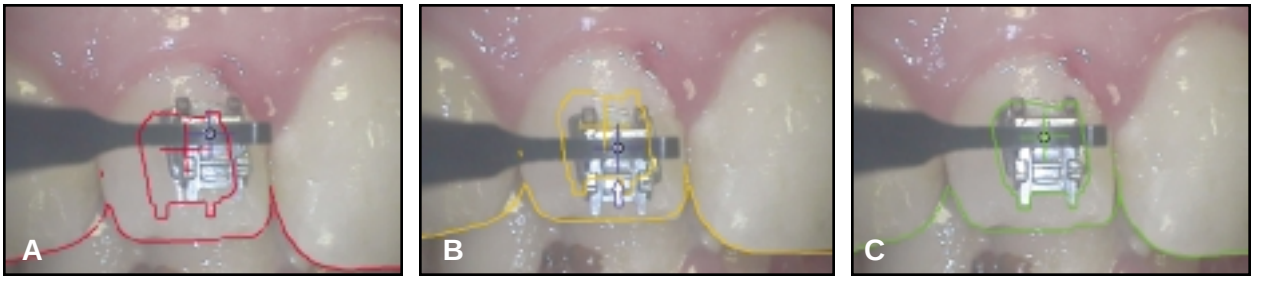

Fig. 4 A. Initial placement. B. Closing in on target. C. Bracket locked on target.

cases where the OrthoCAD perspective saved us unwanted wire-bending or repositioning appointments.

The story actually goes further than that. The initial bracket locations of the virtual appliance are based on the original vendor prescription and a universally accepted placement technique. From there, a set of user-friendly tools allows the operator to fine-tune angulation, mesiodistal position, height, and even torque. One can rightfully question the wisdom of modifying torque in a preadjusted appliance, but the software offers a search function that scans the data base of more than 3,000 appliances, attempting to find a better-matching selection.

In theory, this feature can be used to tailor an individualized appliance set made up of standard off-the-shelf components. Imagine a time when instead of managing (and financing) complex inventories, we will be able to order such a customized set, to be delivered one day prior to the bonding appointment. Considering the potency of today's online ordering and processing systems, I think this day is closer than most of us can imagine.

Fig. 5 Activation of tacking light after targeted location is confirmed.

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REFERENCES

1. Sondhi, A.: Efficient and effective indirect bonding, Am. J. Orthod. 115:352-359, 1999.