CAD Brace Digital: Fully digital orthodontic indirect bonding

By Terence Whitty

"CAD Brace Digital offers an affordable accurate solution to computerised indirect bonding which ultimately allows the clinician to spend much less time chairside..."

Patient demand for straight teeth is now greater than ever and millions of dollars are being spent every year on advertising this ideal. Straight white teeth these days suggests a healthy youthful aura even on older patients and people are catching on fast. There are many ways these days to get that elusive perfect smile but there is no more efficient and reliable way to get teeth straight than with good old fashioned braces. Invisible aligner therapy is definitely all the rage but often it is not suitable for some patients for a variety of reasons. In these cases, you need to be able to offer alternatives or they often just walk on to the next practitioner that can offer them a solution.

Orthodontic brackets are inexpensive to place, very efficient and in some countries, very fashionable. So often this is a good choice as a treatment modality. Orthodontic brackets - or what most patients know as "braces" - are usually positioned onto the teeth with adhesive chairside, one at a time in effect, using a direct bonding technique. This is a time-consuming process and one that takes great skill by the clinician to position the bracket optimally. There are services available that supply robotically bent archwires that can minimise exact placement of orthodontic brackets but this can add expense to the treatment and when all is said and done, nothing really beats a foundation of good bracket placement. This takes great skill to do by hand and eye. However, there is an alternative to this direct bonding technique. Indirect bonding method is where the brackets are setup on a model of the patient's teeth first and a transfer tray is then made. This tray is used to position the brackets onto the teeth, typically in groups.

Scientific studies have concluded that the indirect bonding technique is significantly (twofold) more accurate than the direct technique for all teeth in both labial and lingual orthodontics. Despite the accuracy and clinical time salvaged, 90% of clinicians still do not use indirect bonding. Many reasons exist for this choice: materials expense, required laboratory technique, training of personnel, difficulty in achieving consistent and predictable bracket adhesion to the teeth and more.

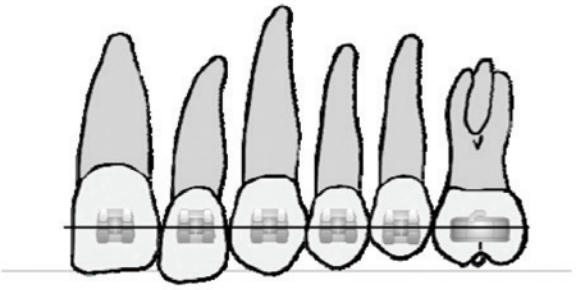

Figure 1. Brackets placed incorrectly can lead to undesirable results - note height of brackets on crowns.

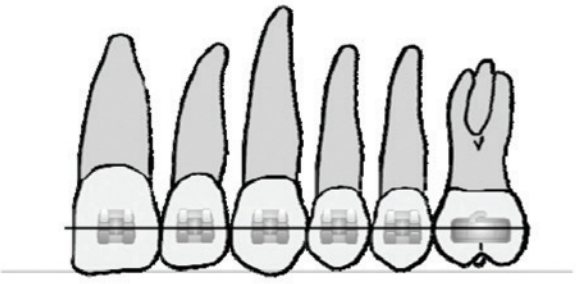

Figure 2. When brackets are placed correctly, desirable movement is the result. Bracket positioning is critical!

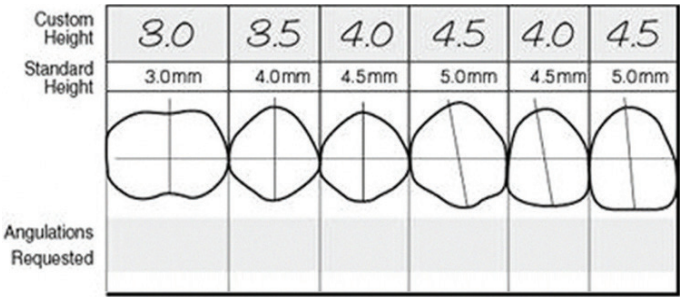

Figure 3. A typical prescription. The numbers indicate a measurement from the incisal edge or cusp tip. CAD Brace can deal with standard or custom prescriptions.

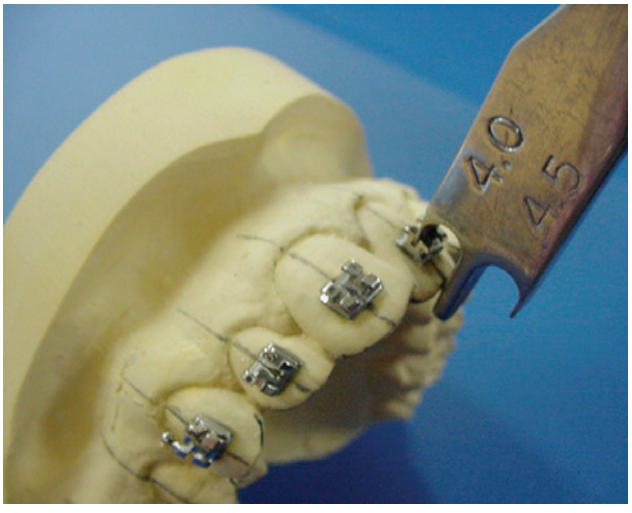

Figure 4. Old school manual positioning of brackets on a model for indirect bonding.

Many clinicians feel that insufficient pressure on the bracket during curing of the adhesive causes the failure of brackets to bond to teeth with the indirect method. Polyvinylsiloxane and vacuum or pressure formed transfer trays can have excessive flexibility that prevents tight contact between bracket and tooth during the adhesion process. However, when the technique is utilised correctly, studies have shown there is no difference between the bond strengths of orthodontic brackets bonded directly or indirectly.

The pre-adjusted edgewise appliance is probably the most popular bracket system available today and the positioning of these brackets when attached to an archwire allows for three-dimensional movement of the teeth. The height and inclination of the bracket on each individual tooth is adjusted so a wire can fit into the bracket slot thus aligning the teeth (Figures 1 and 2). This is an overly simplified explanation, but conveys the basic idea.

Now with CAD BRACE Digital using computer scanning and CAD design, the bracket position can be precisely computed within micron accuracy. This exact bracket placement is computed based upon the standard common prescriptions available and also the final tooth position can be visualised if required.

The process is simple:

1. A scan is taken of the patients dentition with an intraoral scanner. Of course an impression or model scan could also be used if suitable but an intraoral scan is superior for the full digital approach.
2. The brackets are selected from the library. If your bracket system is not in the library, it may added if the files are available from the manufacturer. This makes CAD BRACE potentially capable of using any bracket system. Incidentally we use, recommend and supply by default quality German-made Dentaurum brackets.
3. The teeth are identified in the software.
4. The computer will then correctly compute the ideal position of the brackets. Manual adjustment can be made to fine tune the bracket position if desired.
5. The transfer tray is then created in CAD and then 3D-printed from a special material.
6. The trays are delivered to the doctor, either unloaded or loaded with the brackets in place.

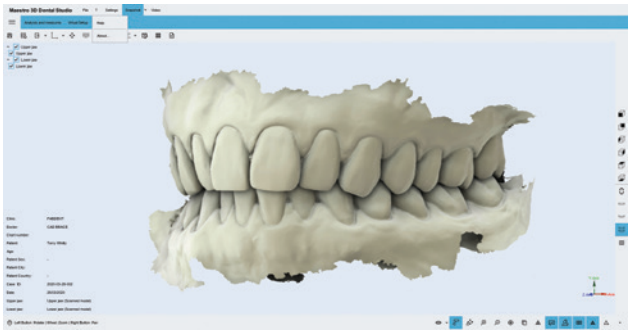

Figure 5. Intraoral scans imported into the CAD Brace software.

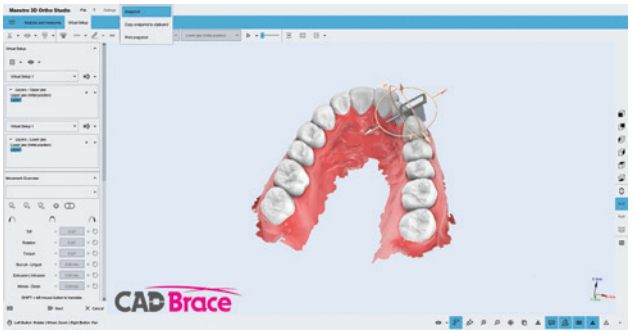

Figure 6. Many measurements and functions can be performed on the models in CAD. Here IPR can be used with precision accuracy!

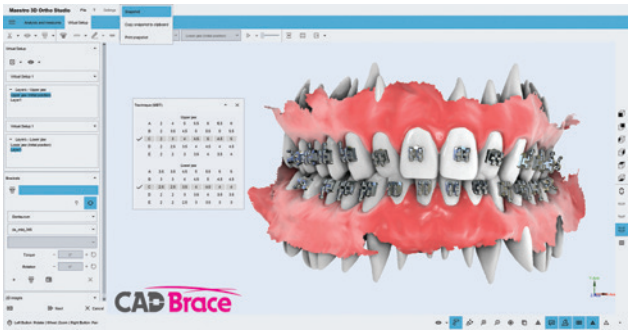

Figure 7. Brackets are placed on teeth automatically.

Figure 8. Upper Jaw with brackets in positioned.

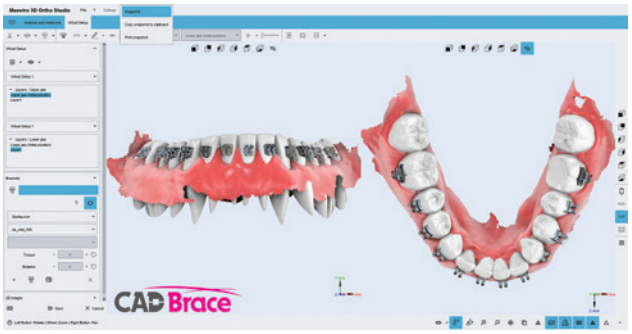

Figure 9. Lower Jaw with brackets in position.

Figure 10. Individual brackets can be adjusted accordingly.

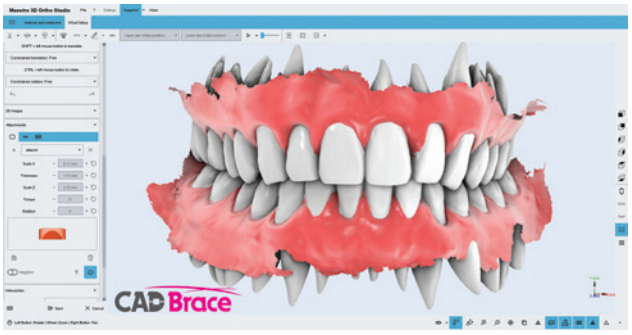

Figure 11. Visualisation of the final result if desired.

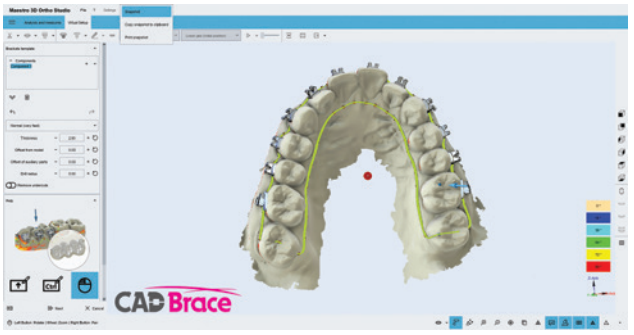

Figure 12. Drawing the outline for the bracket tray.

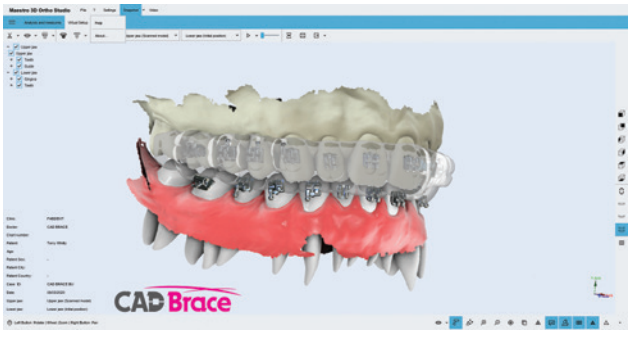

Figure 13. Upper bracket tray is generated; lower in same way.

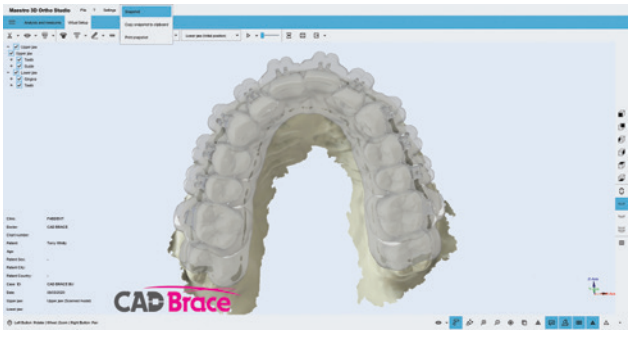

Figure 14. Upper bracket tray occlusal view.

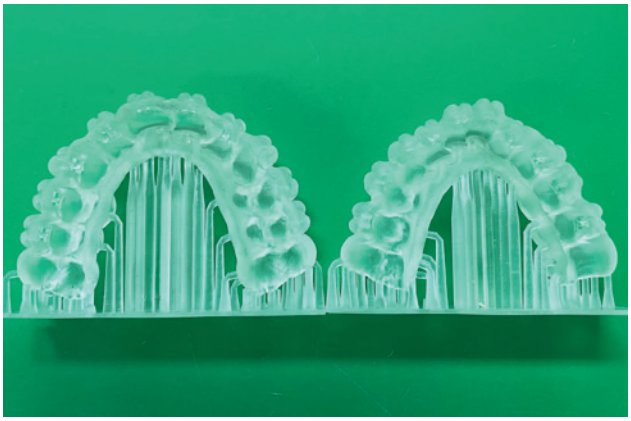

Figure 15. 3D printed Bracket trays upper and lower.

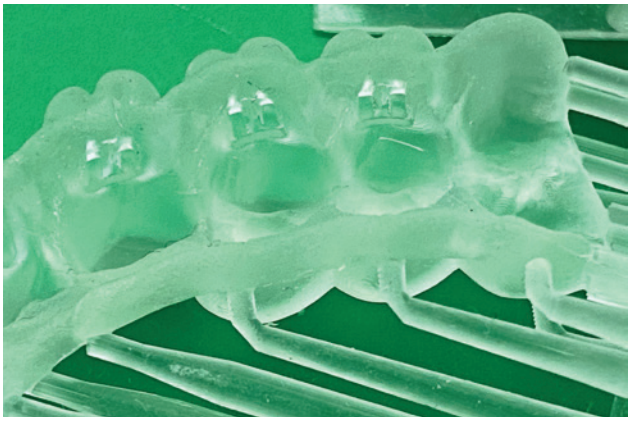

Figure 16. Closeup view of printed tray with proprietary slot for bracket.

Figure 17. Bracket trays loaded with Dentaurum brackets, you can of course load buccal tubes too if you wish.

Figure 18. Closeup of seated brackets, the fit is intimate and the bracket pad is fully clean ready for bonding.

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Using a 3D printed transfer tray has many advantages over hand made or thermoformed trays. The accuracy of the 3D printed trays has to be seen to be appreciated. Using this technology produces a tray that fits perfectly and the material is firm in the mouth and holds the brackets snugly. In actual fact, the fit of the bracket in the tray is better than perfect. This is due to a unique proprietary method of creating the pocket for the bracket. The pads of the brackets are 100% clean and the transfer tray can be removed with ease without de-bonding the bracket.

The system is very flexible, offering the clinician many options:

1. Setup, design and print done by lab with trays delivered with brackets perfectly positioned in place;
2. Setup, design and print done by lab, then brackets placed in trays at surgery by clinician; or
3. Or the clinician can buy the software and printer and do everything in house.

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Figure 19. 3D printed CAD Brace bracket trays fitted to 3D printed models.

About the author

Terence Whitty is a well-known dental technology key opinion leader and lectures nationally and internationally on a variety of dental technology and material science subjects. He is the founder and owner of Fabdent, a busy dental laboratory in Sydney specialising in high tech manufacturing. Using the latest advances in intra- and extra-oral scanning, CAD/CAM, milling, grinding and 3D printing, most specialties are covered including ortho, fixed and removable prosthetics, computerised implant planning and guidance, TMD, sleep appliances and paediatrics.