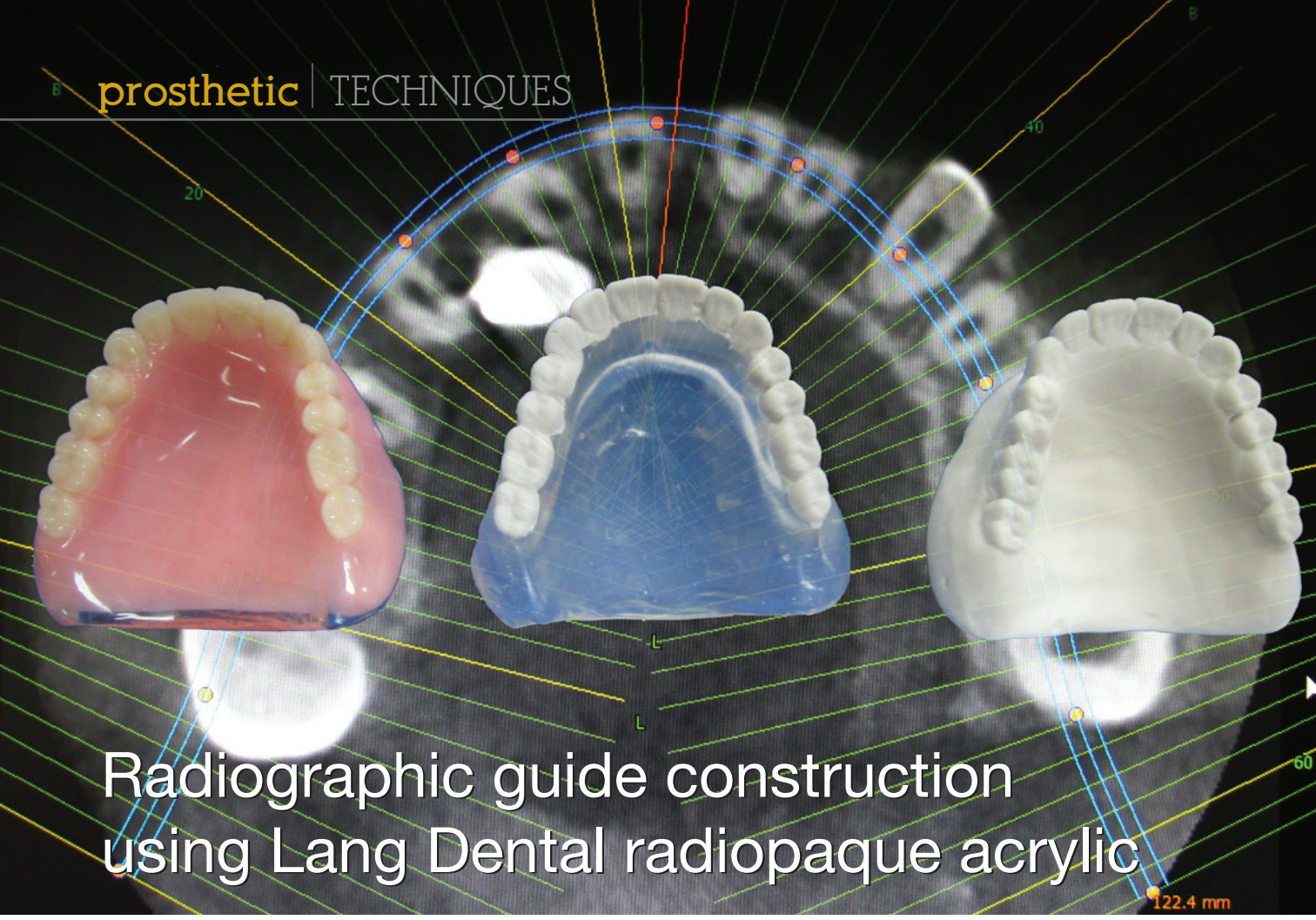

Radiographic guide construction using Lang Dental radiopaque acrylic

By Terry Whitty

"By utilising a scan appliance correctly, the case can be planned from both a prosthetic and surgical perspective prior to the implant surgery... making the process restoratively driven..."

One of the fastest growing segments of implant dentistry is the utilisation of Cone Beam Computed Tomography (CBCT) scan data in conjunction with treatment planning software to enable guided surgery for implant reconstruction cases. In the Jan/Feb 2014 edition of *eLABORATE*, I covered a brief introduction to computer-guided implant placement and described constructing a surgery drill guide using CBCT and a scanned model.

Often, to have a more complete understanding of final tooth position (FTP) in relation to the implant position, a specific appliance worn by the patient during the CBCT scan can complete the picture and help position all the digital data correctly in relation to the final planned prosthetic. This is known as a radiographic guide or more commonly a Scan Appliance. By utilising a scan appliance correctly, the case can be planned from both a prosthetic and surgical perspective prior to the implant surgery taking place, making the process restoratively driven. Focusing on the restorative outcome maximizes the strength, longevity and aesthetics of the restoration... and makes a technicians' life immeasurably easier!

The scan appliance is often critical to this process and to the success of digitally-planned implant cases. Its primary purpose is to show the ideal prosthetic positions of the teeth to be replaced in the digital plan. It also provides an invaluable diagnostic tool to detail the tooth-to-bone relationship. While "virtual computer teeth" are very useful for shorter spans, especially in partially edentulous cases, an appliance in which the teeth have been set in the ideal position and tried in the patient's mouth provides far greater accuracy. Hence, it is usually advisable for edentulous cases to have a scan appliance.

During computer planning and prior to the construction of the drill guide, the scan appliance also helps us sync the optically scanned model to the CBCT scan as well. After the scan appliance is utilised in the planning stage, it is also sometimes modified to create the drill guide, though in the author's opinion, this is not ideal.

There are generally two types of scan appliances in current use today - Single Scan and Dual Scan. The Single Scan appliance is generally made of an acrylic mixed with approximately 20%-40% radiopaque barium sulphate, depending on the application, that allows various structures

Figure 1. Lang Dental's Denture Duplicator Flask is very useful for making scan appliances.

Figure 2. Start by separating the internal flask - Vaseline or silicone spray works well.

Figure 3. Use a regular set alginate - it gives you a bit more working time.

Figure 4. Mix the alginate to a suitable consistency.

Figure 5. Fill the bottom half of the flask with alginate.

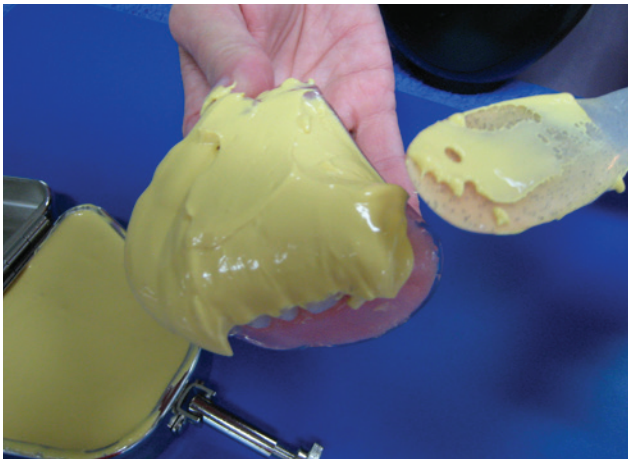

Figure 6. Cover the tooth side of the denture with alginate.

to be seen radiographically. Increasing the percentage of barium sulphate in the tooth portion of the scan appliance can allow this section of the scan appliance to be better identified in the resulting scan.

The Single Scan appliance is worn by the patient during the CBCT scan and will show up in the scan to assist implant placement.

The Dual Scan appliance is often used when scatter from neighbouring metal restorations can obscure the view of the teeth in the scan appliance when using Single Scan appliances. Barium sulphate from Single Scan appliances can also cause issues and obscure the view of potentially vital structures, especially when it is not mixed correctly in the acrylic.

Figure 7. Position the denture into the bottom side of the flask about two-thirds down.

Figure 8. When the alginate is set, trim to remove excess.

Figure 9. Use Vaseline on the alginate to separate the two halves.

Figure 10. Mix the alginate and fill the upper half of the flask.

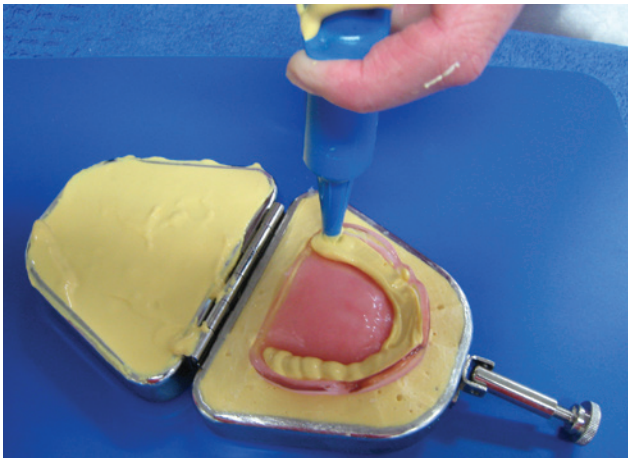

Figure 11. I like to use an alginate syringe to fill the fitting side.

Figure 12. Cover the denture with alginate.

Commercial acrylics are now available to help solve this issue such as Lang Dental's JET XR™ Radiopaque Acylic (Figure 16). Opinions on adding of barium sulphate vary, some say it may affect the quality of the scan, however one could argue when scanning partially edentulous cases that any radiopaque material in the mouth does likewise, such as a crown or other restorations. The optimal method is to always use a good quality cone beam scanner at high resolution.

Dual Scan appliances can also help merge the accurate relative position of the scan appliance, cone beam CT scan and scanned model.

The key to constructing a dual scan appliance is placing what is known as

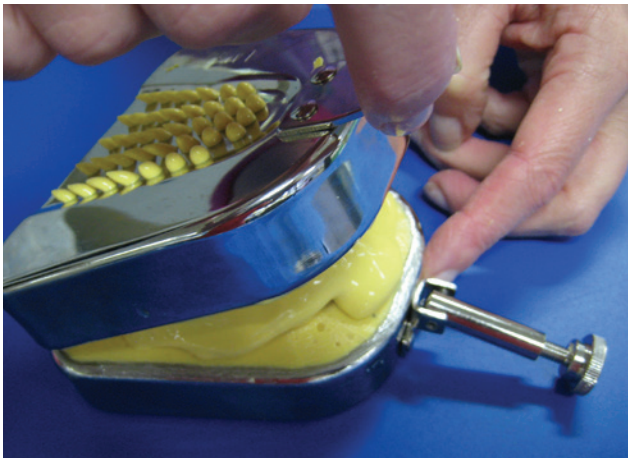

Figure 13. Close the flask and secure the clamp.

Figure 14. Clean up excess.

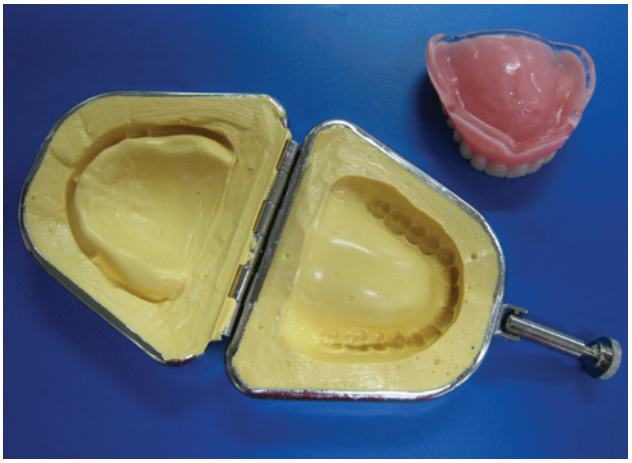

Figure 15. When the alginate has set, carefully open the flask and remove the denture.

Figure 16. Lang Dental's JET XR self-curing acrylic with Barium Sulphate; this is opaque with 40% Barium Sulphate.

Figure 17. Mix the acrylic to manufacturer's specifications.

Figure 18. Use an instrument to dispense the acrylic into the tooth section of the mould.

radiopaque fiducial or reference markers into the scan appliance. Often gutta-percha used in root canal treatments is used but other radiopaque materials are suitable too. Taking a CBCT scan with the patient wearing the scan appliance and another with the appliance on the stone model is the procedure of choice. By doing this, a software merge of the stone model, the scan appliance and the CBCT scan can be accurately achieved by aligning the fiducial markers.

Sometimes, the patient's existing denture can be used as a scan appliance but it will need modification and possible repair or maintenance after the scan is done. An easier way to make either type of scan appliance is by duplicating the patient's

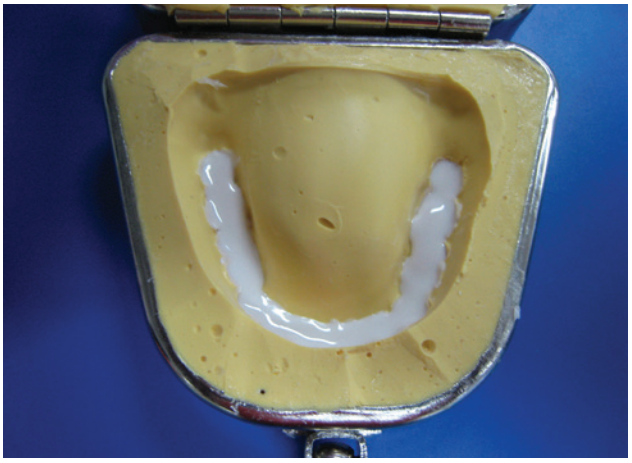

Figure 19. Give the acrylic a few minutes to "firm-up".

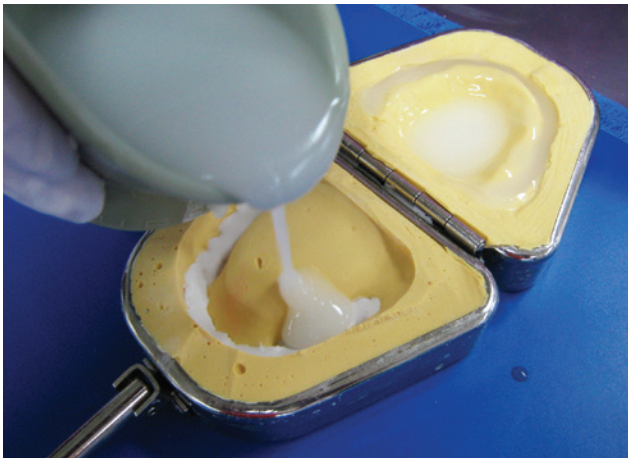

Figure 20. Mix clear acrylic and pour into both sides of mould.

Figure 21. Ensure there is adequate acrylic on both sides of flask. Close flask and tighten clamp.

Figure 22. Cure the acrylic for 15-20 minutes in a warm pressure pot. Don't make it too hot!

Figure 23. When cured, take flask out of the pot, open and remove.

Figure 24. The cured radiographic guide.

existing denture or diagnostic wax-up and this can now be done very easily using the Lang Dental's Denture Duplicator Flask. Lang's barium sulphate premixed acrylic is ideal for use with these appliances and comes in two opacities - 40% Opaque and 20% known as "Shadow". Variations on scan appliances include transparent acrylic with radiopaque (often Gutta-Percha) fiducial markers; Clear acrylic with barium sulphate mixed into the acrylic in the tooth positions and fiducial markers; and barium sulphate mixed into the acrylic in the tooth positions and a less dense barium sulphate mix into the acrylic base of the scan appliance.

This article is a step-by-step guide to the procedure for making an improved scan appliance by duplicating an existing denture using the Lang duplication hinged flask and using Lang's Jet XR Radiopaque Acrylic barium sulphate acrylics and fiducial markers. This covers all the requirements for an optimal scan appliance.

Figure 25. Trim and polish guide.

Figure 26. Mark areas for gutta-percha fiducial markers.

Figures 27-29. Drill small holes approx. 1-2 mm wide, 1mm deep; Heat gutta-percha and push into holes. You can cover with cold cure if you wish. Alternatively, there are radiopaque filling materials that bond to acrylic.

Figure 30. Denture and two different types of guides. The middle one uses clear acrylic for the base and Lang Dental's JET XR for teeth. The one on the right uses Lang Dental's JET XR 40% for the teeth area (opaque) and 20% for the base (Shadow).

About the author

Terry Whitty lectures nationally and internationally on a variety of dental technology and material science subjects and runs a busy laboratory in Sydney's Eastern Suburbs, specialising in high tech dental manufacturing. Using the latest advances in intra- and extraoral scanning, CAD/CAM and 3D printing technologies, most specialties are covered including fixed and removable prosthetics, orthodontics and computer implant planning and guidance. He also specialises in the latest injection systems for traditional and CAD designed removable prosthetics and various associated dental appliances. His articles appear in various international journals. He can be contacted on (02) 9313-7971.