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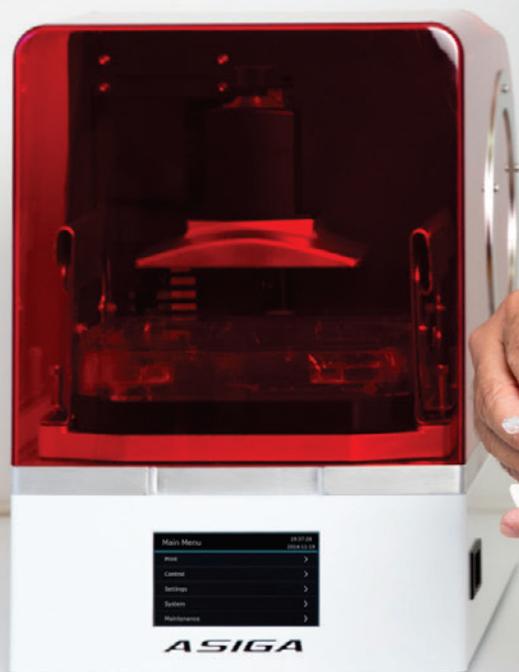
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## AUSTRALIA'S ASIGA AND THE RISE OF DENTAL 3D PRINTING

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Figure 1. Asiga's factory in Sydney, Australia

# Cover story: Australia's ASIGA and the rise of dental 3D printing

By Terry Whitty

One of the big buzzes at IDS this year in Germany was 3D printing. It seemed everyone had a printer on their stand - from the well-known players in the digital dentistry game through to manufacturers of traditional dental products playing catch-up.

One brand of 3D printer, in particular, was prolifically represented far and wide at the show. As we walked the vast halls of the Cologne Fair Grounds, Asiga 3D printers were everywhere - building to a crescendo that ended at their own dedicated stand amongst the 163,000 square metres of exhibition and 2,304 other exhibitors.

Despite launching the world's first LED based DLP 3D printer back in 2011 - an eternity in the digital realm - Asiga is somewhat of a dark horse. Whereas we'd heard the name and the reputation it is building is nowhere more evident than at the IDS, the origins of the system were harder to define. *Was it American? Was it from Europe?* Well, in fact, the answer is that Asiga is designed and built in Australia, a stone's throw from Sydney Airport.

Asiga had their full range of dental specific 3D printers at IDS as well as launching the new Asiga MAX, aimed at printing for the dental profession using an open format and the ability to print models, trays, surgical guides, splints, temporaries, patterns for casting and more.

The Asiga MAX DLP 3D printer boasts a ton of features at a fraction of the price of similar units and with unique proprietary features found in no other printer.

## 3D Printing: The state of the art

There are many technologies used by 3D printers but the main ones include Stereo Lithography, Digital Light Projection, Polyjet Matrix, Fused Deposition and selective laser melting/sintering. All have pros and cons and applications they are most suited to.

For dental applications, the most suitable category of 3D printers for producing highly accurate dental models, castable resins, surgical guides, custom trays,



Figure 2. The Asiga MAX 3D Printer.

splints and temporaries use light cured liquid polymers. Polyjet matrix printing uses light cured polymers and has been used in dentistry for many years but the high upfront cost, high cost of materials and wastage has kept most punters out of the game. Things have changed quite a bit and like all technology, prices drop.

Stereo Lithography and Digital Light Projection technologies are currently the most affordable prospects for widespread use in dentistry and now there are some very capable prospects on offer for the dental profession.

### Open vs closed 3D printers

We are all familiar with open and closed systems when it comes to scanners and milling systems and yes, unfortunately, the same applies to 3D printers as well. With closed systems, you can only use the printer manufacturer's resins to print with. This can reduce flexibility and increase per-unit cost and in today's world, the trend is that everyone in dental is going open.

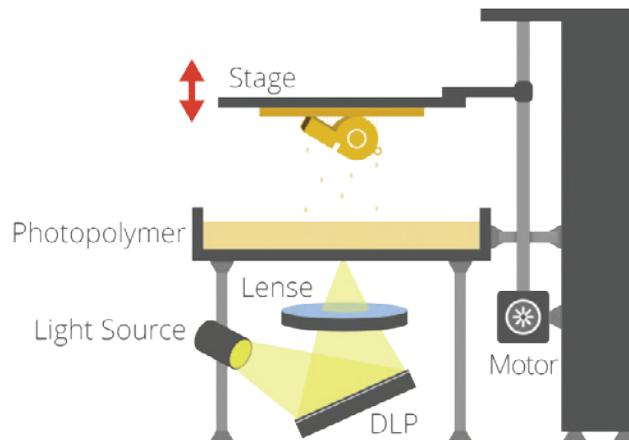


Figure 3. The elements of Digital Light Projection (DLP) printer technology.

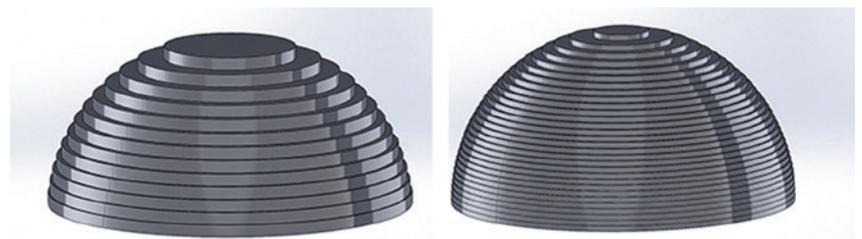


Figure 4. The left diagram shows low Z-resolution (thicker layers) and will produce a coarse finish with a "stair-step" design. A high Z-resolution (thinner layers) (right) will produce an extremely smooth finish and reach a higher level of detail.



Figure 5. Models with high accuracy for crown and bridge applications. Materials: Detax Freeprint Model and Temp.



Figure 6. Printed surgical guide on a printed model. Both from the Asiga MAX. Materials: Asiga PlasPINK and Detax Splint.



Figure 7. Printed splints in crystal clear available on the 385 nm Asiga MAX. Materials: Detax Freeprint model and splint.



Figure 8. Printed special trays. Material: NextDent Tray.



Figure 9. Printed implant model with printed gingival mask. Materials: Asiga PlasPINK and NextDent Gingiva.



Figure 10. Printed model with printed cast partial framework. Materials: Asiga PlasPINK and Asiga SuperCAST HD (green).

Truly open 3D printers allow you to use any resin and do not block features that allow you to use 3rd party resins successfully. What that means is simple: for best value, look for an open printer that allows you to use any material from any supplier.

### Resolution and accuracy

In a nutshell the resolution of a printer is separated into two distinctive segments, namely the Z-Resolution or vertical and the XY axis resolution or the horizontal. The two segments define the accuracy of

the 3D printer and need to be considered carefully when choosing a printer. The Z resolution will define the surface quality and detail. As you can imagine, the thinner the layer, the smoother the finish; conversely, a thick layer will produce a coarser surface, or a “step” finish.

The accuracy of a printer is actually determined by the XY axis and by the type of 3D printing technology used. With DLP, it is determined by the pixel size being projected, so the analogy is as in TVs and computer monitors - the more pixels per area, the better the picture quality. Compare a 1080P TV with a 4K TV and you will see a huge difference. The same is true with DLP - the smaller the pixel, the higher the accuracy. For common desktop DLP systems, the XY pixel size is in the area of 60-70 microns.

With Stereo Lithography, the XY axis resolution is defined by the diameter of the laser; for common desktop machines, this is often in the area of 140-160 microns, making these systems 2-3 times less accurate than comparable DLP printers.

### Asiga MAX 3D Printer

**T**he Asiga MAX is a desktop printer and has a small footprint of only 260 x 380 mm. It's also lightweight, weighing in at 16.6 kg. The MAX has a build size (XYZ) of 119 x 67 x 75 mm, making it suitable for any dental application. The XY pixel size is 62 microns and that is easily suitable for dental crown and bridge models and a whole lot more, detailed later in this review.

Remarkably, Asiga has gone for a completely open architecture, with no restrictions for the MAX 3D, a first for a printer of this quality and specifications. This means you can use any material from any manufacturer that is compatible with the unit. The unit just needs a set of material parameters and you are working. It's truly open, no ifs, no buts. Materials from manufacturers such as Detax, Dreve, Pro3dure and NextDent, to name a few, can be used with this machine right out of the box. Asiga also make their own growing range of materials and these are very affordable choices for everyday use.

The MAX comes in two wavelength models - both 385 nm and 405 nm. What's the difference you ask? If you want to use super clear resins, you will need a 385 nm machine as the clear resins are optimised for this wavelength.

Dental models printed from the machine look excellent as they exhibit a smooth surface with high detail; margins are excellent. You can print solid models with ditched dies using exocad model creator CAD software or you may wish to use

removable die models that can be made with software such as exocad, 3Shape and Dental Wings. Implant models can be printed as well, including rubber-like gingival mask material. For such an inexpensive machine to turn out such high quality models in itself is a game changer, but it does not end there.

Impression trays are done with ease, surgical guides fit well and have good clarity and you can print crystal clear bite splints when the correct material is used. One of the real highlights of this machine is the amazing castable resin prints. These have to be seen to be believed. The surface finish and detail is just amazing. You can use it for your pressable crowns, CoCr casing frameworks or even implant bars.

### Speed

**D**LP is quite a fast printing technology and the Asiga MAX is no slouch. At high resolution, you can print 15mm per hour. Depending how you orient items on the build tray will determine how fast you get your print. During your normal day, for example, you may want a quick turnaround of some dental models. These can be done in an hour to an hour and a half by placing the models horizontally on the build plate. You will only get a few models, but you get them quickly. Overnight printing is a different story and allows you to take full advantage of the machine's versatile capabilities.

### Changing materials

**T**he Asiga MAX has been engineered to make material changing quick and easy. A special reservoir for the material can be changed out in about 30 seconds. This means you can have various materials ready to go in reservoirs and changed in seconds so printing from one material to another is a breeze. These reservoirs also hold a special secret as the base of the build tray is made from a Teflon film. It is this Teflon film which allows for a unique, patented automatic peeling process to occur, offering the lowest separation force of any inverted DLP system. This means the use of far fewer support structures and no chance of deforming the model whilst printing. Asiga's SAS (Slide-And-Separate) and SPS (Smart Positioning System) control the layering process with a high degree of accuracy and repeatability.

"It's hard to fault the Asiga MAX. It's a DLP Desktop 3D printer with a small footprint. It's high resolution, at least twice that of popular comparable desktop SLA machines, it's accurate and ideal for all polymer-based dental applications. It's truly open and already prints some amazing materials which are a breeze to change. It's inexpensive and best of all, it's made in Australia by an Australian company..."

### Software

**A**siga Composer is an intuitive, automatic STL and SLC support and build preparation software package. Based on a special optimal support generation algorithm, parts are automatically supported only where absolutely required by the part geometry. This makes job setup and post-processing a breeze.

Composer will import dental industry standard STL files and works on a Mac, Windows or Linux computer.

### Conclusion

**I**t's hard to fault the Asiga MAX. It's a DLP Desktop 3D printer with a small footprint. It's high resolution, at least twice that of popular comparable desktop SLA machines, it's accurate and ideal for all polymer-based dental applications. It's truly open and already prints some amazing materials which are a breeze to change.

It's inexpensive and best of all, it's made in Australia by an Australian company. But more about that later.

*For more info, see [www.asiga.com](http://www.asiga.com) or contact one of Asiga's local distributors: Fabdent ..... 1300-878-336 Henry Schein Halas ..... 1300-658-822 Ivoclar Vivadent ..... 1300-486-252*