

Models being printed on an Objet PolyJet 3D printer from tdl Precision Orthodontics.

# 3D dentistry

3D printing makes it possible to manufacture crowns, bridges and other orthodontic appliances on demand. **Charmaine Teoh** takes a look at the printing technology that's revolutionising the dental industry

**3**D printing has attracted significant attention in recent times for good reason: the technology is transforming the speed, ease and cost at which products can be manufactured. What's more, 3D printing is accessible to almost everyone, from NASA scientists and car manufacturers to fashion designers and students of all ages.

The applications for the medical and dental professions are particularly exciting. Medical experts have created a jaw, a pelvis and several customised hip replacements from metal. Dentists are producing bridges and crowns in

their practices. Such is the interest that the medical and dental market for 3D printers is set to grow by 365 per cent to \$US867 million by 2025, according to the research firm, IDTechEx.

So, what is 3D printing? You start by uploading a 3D scan of the object or a computer aided design (CAD) file to the 3D printer. Instead of ink, the printer sprays out layer upon layer of a plastic or metal gel or powder in the shape of the object. In a number of hours, you'll have a product that's as good as anything manufactured using conventional processes.

Dental laboratories around the world are using 3D printers to print

a wide range of items, including digital impressions from intra-oral scanners to create orthodontic appliances, crowns, bridges and acrylic and cobalt chrome denture fabrications; sequential models for orthodontic aligners; pre-operative diagnostic models for surgical planning; titanium implant components; and surgical drill guides. The materials used in 3D printing are typically tough, acrylic-based plastics in a variety of colours and grades. Bio-compatible materials that are suitable for prolonged use in the mouth are also available.

In Australia, the use of 3D printing in the dental profession is beginning to gain traction. One of the earliest to adopt the technology is Victoria-based tdl Precision Orthodontics. The orthodontic dental laboratory offers Cloud 3™ rapid prototyping services and manufactures fixed, removable, functional, medical, thermoform and surgical appliances; digital study models; and sequential aligners.

"We bought our first 3D printer in 2009 on the back of seeing a YouTube video and being totally intrigued at how a machine could create a fully functioning, three-dimensional, shifting spanner with no assembly needed,"



**Sequential aligners with printed models from tdl Precision Orthodontics.**

## Quote

Sid Tass, Precision Orthodontics founder/managing director

**"In 2009 we could print six dental models in 48 hours at a not-so-high resolution. Today we can print 44 dental models in 4.5 hours."**

says Sid Tass, founder and managing director of tdl Precision Orthodontics.

The lab now has the latest state-of-the-art 3D printer and is re-skilling technicians, who work in a plaster room pouring, trimming and numbering fragile wet models, to use the 3D printing technology. The current equipment can produce extremely accurate (16 microns) models in a few short hours with minimal human involvement.

"In 2009 we could print six dental models in 48 hours at a not-so-high resolution. Today we can print 44 dental models in 4.5 hours," says Tass. "We've also experienced dramatic time savings because impressions from intra-oral scans are emailed instead of needing to be physically picked up from our clients."

The time and production efficiencies enable tdl Precision Orthodontics to offer clients high-quality products in short timeframes, a major competitive advantage over labs that don't utilise

3D printing. "For example, we can offer sequential aligners that are digitally produced using specific, intuitive software, which is complemented by high-resolution, cost-effective work models," says Tass. "We can also fabricate retainers ready for insert on the de-band appointment, so the patient doesn't have to make another appointment to have their retainer inserted. We have the de-band scan on file if the retainer needs to be repaired or replaced, so there's no need for a new impression or even a surgery visit—the patient just has to call us."

Tass estimates only five to 10 per cent of the Australian dental profession is currently using some form of 3D printing technology. This is mainly due to a lack of knowledge about 3D printing processes (including 3D

intra-oral scanning and 3D manipulation software) and the size and high cost of printers. A top-of-the-range commercial printer, like the one used by tdl Precision Orthodontics, can weigh in at up to 450 kilograms. The price tag can range from \$60,000 to \$500,000 and upwards.

"However, as more people become aware of and understand how the technology works, it's inevitable that they will all require access to this technology, especially with the interest in and momentum surrounding intra-oral scanners," Tass says.

A new generation of smaller, more affordable printers may spur the take-up of 3D printing in the Australian dental industry. Printers such as Stratasys' Objet30 OrthoDesk desktop printer are more compact and cost around

**3D-printed dental wax-ups on ProJet 1200 from 3D Systems.**



one-third the price of high-end systems. The cost of delivery, installation and training for desktop systems starts from around \$37,000 plus GST.

“When evaluating 3D printers, dentists should consider accuracy, surface finish, throughput, cost per print and post-processing (if any) of the printed parts,” says Matt Minio, managing director of Objective 3D, the largest distributor of Stratasys 3D printers in Australia and New Zealand. “Almost as important is a reliable supplier who can provide all your materials, maintenance and service needs, as well as ongoing technical support for your system.”

Minio assures novices that the 3D printing process is pain-free. “I liken it to preparing a detailed PowerPoint presentation,” he says. “The skill is in preparing the data you want to print. Producing the document is as easy as file printing. 3D printing is similar; once the 3D model has been scanned or prepared, the process of 3D printing is the easiest part.”

Before investing in 3D printing technology, Tass explains, dental



Henry Schein Halas will market and sell the 3D micro-SLA ProJet® 1200.

practices should consider whether they have the space, staff and funds to install and maintain a 3D printer, as well as the ability to adjust workflows and hire or train technicians to operate the equipment.

“3D printers will soon be a standard piece of household equipment to

print food, consumable parts for toys, tools and equipment,” explains Tass. “In the dental industry, material scientists are racing to create printable materials to replace traditional biocompatible materials used to fabricate dental appliances. The future for 3D printing is bright.” □

# Let Garrison Improve Your Class II's.

Clinically-proven, perfected Class II results versus Tofflemire\* bands

\*Tofflemire is not a trademark of Garrison Dental Solutions

## Composi-Tight® 3D XR

Sectional Matrix System

Now with the all **NEW**  
Astringent Wedge

More than your typical wedge,  
it's a wedge plus an astringent.

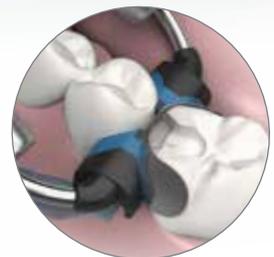
**A+Wedge**  
Controls Gingival Bleeding



**PLUS A \*FREE assorted pack of A+Wedge (GWAS02) with purchase of 3D-KSA-10**



\*To redeem free goods, simply email a scanned copy of your invoice to ewong@garrisdental.com dated 01/04/2015 to 31/05/2015. Promotion code ADAU0415 is only available in Australia. Please use ADAU0415 in the subject line. Allow 4 to 6 weeks for delivery.



**HENRY SCHEIN® | HALAS**

**Rely on Us**

www.henryschein.com.au Orders: 1 300 65 88 22

**erskine dental**

www.erskinedental.com.au  
Orders: 1 800 81 71 55

**Garrison**  
Dental Solutions

Email [ewong@garrisdental.com](mailto:ewong@garrisdental.com) or call +61401 331 103  
US Ph 616.842.2244 • US Fax 616.842.2430 • [gds@garrisdental.com](mailto:gds@garrisdental.com) • [www.garrisdental.com](http://www.garrisdental.com)

ADAU0415