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3D printing hunger games: So what's exactly in a name?



The hunger is on for 3D printing options in labs and dental surgeries but *are we there yet?* Not necessarily. Are we about to start 3D printing everything with the ensuing demise of milling altogether? Well not for a while yet. In my travels and discussions I'm constantly asked *what is good, who do I buy from and can you just hit the button to print.* So I thought it's time to review and discuss how manufacturers and distributors translate key terminology and communicate (market) the process to you, the end user and provide an overview, albeit briefly, into the world that is dental 3D printing:

1 Terminology in 3D Printing: This is an area we all need to become familiar with as we move into the field of Additive Manufacturing (AM) a.k.a. 3D printing. It's the process of joining materials to make parts from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing (i.e. milling). AM acronyms are recognised by ISO/ATSM 52900 as a standard definition. This generally allows a prospective buyer to compare models (apples and oranges) with manufacturer data but some acronyms are purely marketing hype - so be careful.

2 3D Printing Manufacturers: Products from 21 different manufacturers of 3D printing systems (with multiple systems and price points) utilising either SLA, DLP-SLA, MSLA, SLS or SLM technology are available in Australia. A few manufacturers have multiple re-sellers of their equipment from either dental/medical/audiology or jewellery distributors. Review the supplied CAM software as specific dental applications are required. In essence the lower priced units offer printed models (orthodontic and check models) and surgical guides. As the price point goes up, so does the accuracy, quantities to print (build platforms) and material options. There is expertise in metal 3D printing for the manufacture of dental frameworks (RPD's, PFM frameworks and implant structures) as well as reconstructive surgery (CMF applications) being particularly prominent.

3 3D Printing Materials and Post Processing: Specific 3D printing material manufacturers are in the dental field such as Detax marketed under the FreeDent brand, Dreve with Foto Dent and NextDent (recently purchased by 3D Systems) which is also an OEM for multiple 3D printing manufacturers in dentistry. Be aware of the approved applications related to the class of material (Type / Class 1 or 2) as well as the curing wavelength of the 3D printer. An important consideration in your selection is that some manufacturers only have settings for their supplied resin materials. So the option to use other resin materials from other manufacturers or tweaking software may not be available. There is also the post processing which may require one or more steps taken after the completion of an AM build cycle in order to achieve the desired properties in the final product (such as light curing).

4 Build Chamber, Build Envelope and Build Volume: The **build chamber** is the enclosed location within the additive manufacturing system where parts are fabricated such as RPD's, surgical guides and CMF prosthetics. The **build envelope** is the largest external dimensions of the x, y, z axis within the build space where parts can be fabricated. This dimension is important in

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consideration for a horizontal or vertical build of your parts and relates to time taken to print a part. **The build volume** is the total usable volume available in the machine for building parts. Lastly manufacturers will potentially talk about **Resolution** (the x, y axis) and layer thickness. The lower the resolution (thicker layers) the more pronounced the edge of curve becomes (it looks like a step). Alternately printing at a higher resolution, the layer is thinner and the curve appears smoother. This is an important consideration on small detailed objects or connectors as some surfaces are better printed in a vertical position rather than a horizontal position. Some manufacturers allow you to change the print quality and some don't. More to think about!

5 Maintenance and ongoing costs: Consider having multiple resin trays/baths for different materials and you will need to keep your unit clean. It's just not about pressing the button and hey presto. The take home message is to review the manufacturer's care instructions, have spare parts and replacement resin onsite and maintain your unit!

There is a place for 3D printing in dentistry but before jumping in, get familiar with AM terminology, understand the differences in technologies and the respective outcomes each can deliver, as well as the costs and efficiencies of the process. After that, it's much easier to then select the correct 3D printing solution for your lab or clinic and design an appropriate workflow. Serious consideration to your return on investment (ROI) should be part of your decision making process. Consider outsourcing initially while you discover the process and ask lots of questions!

Have a plan and review those stages and that is how DDC can engage with you at the level matching your needs when and where you require specific advice or support.

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