# How We Integrated 3D Printing: *Stories from Five Forward-thinking Dental Laboratories*



**DENTAL TECHNOLOGY SOLUTIONS** 

## Introduction

"Indeed, the impact of 3D printing in the dental industry is quite important and this sector is actually making the most of additive manufacturing technology. Additive manufacturing is the perfect solution to get customized items, for all sectors. But it becomes even more relevant when it comes to the medical sector, as it allows great realizations such as prosthesis."

- Lucie Gaget, Sculpteo Dec 18, 2017

There can be no doubt that 3D printing is in the dental laboratory to stay. To verify that, just look at the number of companies manufacturing and selling 3D printers and materials to dental labs. Attend a dental meeting and you'll be shocked by the number of them. 3D Printing is playing an ever-increasing and important role in our industry.

Purchasing a 3D printer is easy. Just make the decision to do it and arrange for the financing. The more challenging part is smoothly integrating the technology and work-flow into your day-to-day business. This eBook will give you the opportunity to find out why five dental laboratories decided to buy them and what they did to fully incorporate them into their workday.

#### Our CAD/CAM History

Artistic Dental Laboratory has always had pride in being a progressive laboratory since its inception in 1981. From the Procera Mod50 to 3Shape's D2000, our CAD/CAM Department has grown to be the highest volume department in the laboratory and the most fluid department when it comes to change. We started dealing with Intraoral Scans (IOS), as many labs did, by accepting Cerec scans from doctors who did not want to, or could not, mill the materials they needed in their office. That's when the need for a 3D printed model first arose. At that time we had such a low volume, and the technology to print these models was so costly, we were fine with outsourcing the models. It was costly, and the service was lackluster, but it got the job done.

### Lab Profile



Author: Danny Ulasek
Location: Chicago and Bolingbrook, IL
Lab Type: Full Service Certified Dental Laboratory Since 1981
No. Employees: 80

As new IOS systems emerged, more doctors were sending in digital impressions. Artistic Dental Laboratories had long foreseen IOS technology as a possible disruptor in the dental field and we were eager to adopt this digital technology into our workflow. After all, at the lab, we had been using 3D scanners in the CAD/CAM Department for over 7 years.

For us, the shift came in 2016. Prior to that we were getting about 10-15 IOS cases a month. In December of 2016, we saw that number jump to over 70 a month. At that time, it was mostly Cerec and iTero cases with a couple others mixed in. Then came the big wave in 2017. Trios had taken the market by storm. 3Shape was no longer just the big dog in laboratory scanning, it was primed to take over chairside scanning as well. Our IOS cases went from 70 per month to 10 per day in just a few short months.

#### Deciding to Purchase a 3D Printer

At that time, we were outsourcing our digital models. We knew that with the increased volume it would be more cost effective to produce the digital models in house. We never extend our ROI out more than 24 months. For a \$25,000 equipment purchase we knew we needed to be outsourcing about 5 sets of models a day on average to justify the initial cost – in addition to the daily operating cost and supplies of the machine. Each machine is different so we researched different models. However, the biggest problem we ran into was that we had gained so much volume, so quickly, we no longer had much time to research and learn how to 3D print.

#### How We Decided

We had been researching printers for a while and had almost pulled the trigger on a couple- even going so far as having the finance form signed before we decided that we needed to take a look at some other printers that were coming to market. Enter Chris Frye and Whip Mix.

We had always had a great relationship with our friends at Whip Mix, and now we were being offered a chance to Beta test a couple of new printers for them. It was as much of an experiment on their end as it was ours because we were not yet 3D printing and they were willing to send us some very expensive equipment to see how things went. We took our bumps and bruises at first, but Cory Lambertson and his digital tech support crew were always there to help us out and get us going again. With their help we were able to navigate the learning curve rather quickly and eventually ended up purchasing two Asiga Pro 2 printers to handle just the model work from our IOS cases.

We knew that models were just the beginning. We had plans of doing guided surgery cases, and possibly hard splints as well. That was a huge part of why we were so intrigued by the Asiga line. It was easy to change out trays for new materials and the build time was pretty short, i.e. requiring only 3 hours to print a full tray of models at 50 microns resolution. The fact that the printer was open source was also a plus. It would allow us the flexibility to change materials as new materials became available. It was an easy decision as we would not be locked into one manufacturer's material, and we had the flexibility to change out materials in minutes with zero material waste, unlike some of the others we were looking at.



Photo credit: VeriModel OS resin, Whip Mix Corporation

### Day 1

When our first printer was delivered, we were ready. We had a room in the lab upgraded with an industrial 2-shelf set up that would allow us to maximize the space; printers up top, materials and supplies down below.

Once installed, things went pretty smoothly right out of the box. We had them up and running in a couple of hours and had very little down time. A small miracle in my eyes, as we had no one in the lab with more than a couple of months printing experience, and our "IT Department" was an outsourced one. They had almost no experience at all dealing with 3D Printers. There was very little need for them however. The Asiga software took in .stl files, and was pretty easy to learn. It dropped into our current CAM set up with very little problems. It was like we were sending a crown to the mill, but instead it was a model that went to print.

#### The Integration

I handled the printing for the first couple of months as I was the architect behind the network of files that flow through the CAD/CAM Department. I wanted to make sure we didn't need to change anything major. Soon after, I began training a permanent technician. I selected a team member from our

scanning team because of her textbook-like notes and attention to detail. She was a very organized person and I knew that when I had to move her onto a new challenge, her notes would serve as an instruction manual for the next technician. It turned out to be the best choice I could have made. We got lucky in having that person ready and waiting for the opportunity. I would imagine most labs have a person like that waiting in the weeds. They need to be at ease with computers and machines. The people who come back there and ask questions about the new machines are probably the people you want to train to work with it. They will be engaged in the new technology and eager to learn more about something they probably have only seen on TV.

### Our Future with 3D Printing

We have since started printing surgical guides and are in the process of digitizing our splint line as well. The only problem we have is that IOS cases have since doubled and our versatile printers don't have time for anything but models. We purchased a couple of well-known, less expensive, printers in order to handle the small parts we were starting to print and added those into the system as well. Looking back I'm not sure how we ever did IOS cases without these printers. In the beginning we looked at 3D printing as a luxury and an expensive entry-level technology, but the technologies we purchased through Whip Mix turned out to be about the cost of a new zirconia mill. It was a relatively easy learning curve and something I consider a permanent new technology at Artistic Dental Laboratories.



### **Ford's Dental Lab**

#### Our CAD/CAM History

The world of dentistry is rapidly evolving. When I began my journey as a dental technician just 5 years ago, our small family laboratory did everything by hand. All of our prosthetics were crafted traditionally as they had been for the several decades. But as with all other industries, new technology has revolutionized the way we expanded our business. We faced a very sobering decision. Would we adapt to this new technology and survive, or rest on our laurels and be left in the dustbin of dental laboratory history? We chose the former.

The task of digitizing our fixed prosthetic department was not an easy one. We had been utilizing CAD technology for our zirconia units for several years, but we wanted to digitize the remainder of fixed operations. It required learning new skills and a lot of trial and error. With rumors of intraoral scanners swirling around our dentists' offices and the temptation of increasing our productivity, we decided to purchase our first 3D printer. After several months of intense research, we chose the Asiga MAX.

### Lab Profile



Author: Bryce Hiller, Technology Manage Location: Nelsonville, OH Lab Type: Full-Service No. Employees: 5

## **Ford's Dental Lab**

### **Expectations**

Our goals with the MAX were not grandiose. We had two main tasks we sought to utilize the printer for: models and castables. Several of our large accounts had mentioned the possibility of purchasing an intraoral scanner in the near future, and we wanted to be ready. The cost of outsourcing our model printing from a digital impression would cut heavily into our profit margin (we saw prices everywhere from \$15-\$30 per case). Our conventional stone model work cost a fraction of that, even with labor. We knew that printing our models in-house would be necessary, and we wanted to have the capability to do so as soon as the doctors received their intraoral scanner. A seamless transition for the doctor would keep our working relationship positive and exciting. Our second goal was to print our full contour gold crowns and metal substructure patterns in a castable resin. We had already digitized all of our fixed restorations and were outsourcing the 3D printing. Some secondary goals included surgical guides, custom trays, bite splints, partial frameworks and, when the materials become available, long term removable prosthetics.

#### The MAX

I had several requirements when I was researching 3D printers. The biggest requirement was to have a printer that was open source. I knew that we would want the freedom to use whatever third-party materials we liked. The ease-of-use, particularly when switching between resins, was an important consideration for us. In our business, time is money. The MAX's ability to switch resin trays in 15 seconds was incredibly attractive to us. Quality of print is obviously a factor, and I would encourage anyone interested in the MAX to send your own sample file to Whip Mix to be printed. You won't be disappointed.



## **Ford's Dental Lab**

### Integration

Ease of integration is important for every piece of equipment in a laboratory. The MAX is incredibly easy to integrate into your workflow. If a lab is already comfortable with CAD technology, the transition is next to seamless. While it may be helpful, you don't need a team of IT experts to work a 3D printer into your workflow. Find a couple people on your team that are somewhat tech-savvy and train them. Supporting and maintaining a 3D printer is simple and can be learned quickly. A weekly calibration and quick cleaning after each build will keep everything running smoothly. We use Dental Wings and the integration of our MAX into this workflow was virtually seamless. Training was quick and straightforward, and I felt like Whip Mix had equipped me with the knowledge I needed to adequately implement 3D printing.

### **Cost Analysis**

3D printing is quite affordable. The purchase price for our MAX seemed daunting at first glance, but the value that it has provided us is outstanding. By completely digitizing our crown and bridge process, we have increased our productivity dramatically. Labor costs have been slashed, which means more accounts can be taken on. When a single full contour unit can be scanned and designed in 10 minutes or less, then nested in seconds, anyone can see the benefit. Material costs are equally low as well. Outsourcing printed crowns can cost anywhere from \$5- \$10 per unit. The material cost for us to print these same units is probably a dime. Models are very affordable as well. We print hollow models with removable dies and the cost is around \$3- \$4 per quadrant and \$5- \$6 per full arch. The benefit of having a printer that is open source is the ability to use the cheapest materials that provide a good product. This allows labs to keep costs down, maximizing profit.

#### Conclusion

3D printing is part of the future for dental laboratories. We are ecstatic about our decision to purchase the Asiga MAX. It has radically increased our productivity. The MAX is incredibly easy to train on, operate, and maintain. The accuracy is unparalleled and the quality of prints is excellent.



Photo Credit: VeriModel OS resin, Whip Mix Corporation

### **Derby Dental Lab**

### Our CAD CAM History

As an early adopter of CAD/CAM and Digital Dentistry, Derby Dental Lab has been working with digital accounts for several years and we continue to see that number grow. In 2015 we had just 9 IOS /digital accounts prescribing Crown & Bridge restorations with us and managed just over 100 printed models through an outsource laboratory, iTero<sup>™</sup> and 3M<sup>™</sup>. By the end of 2016, our digital account base had more than doubled and we were outsourcing an average of 45 models a month with an average outsource bill of \$1,000 per month. As we evaluated our options for growth, adding a 3D printer to our equipment portfolio seemed like the next logical step to advance our laboratory and expand our offerings.

### Lab Profile



Author: Nan Boyd, CDT Location: Louisville, KY Lab Type: Full-Service No. Employees: 75

### **Derby Dental Lab**

#### Deciding to Purchase a 3D Printer

As we began our research and search for a printer, we had a few key features we were interested in: Speed, Accuracy, Capacity and Versatility. We had an immediate need for printing Crown and Bridge models however we were also interested in an open printer with the ability to easily switch from one material to another. During our research, we sent .stl model files to several printer manufacturers who were willing to print samples for our evaluation. The quality of models produced on those printers, from the small desktop units to the larger units, including but not limited to Carbon, Prodways, Structo and Envisiontec were all comparable, with some providing a higher level of detail and smoother surface finish. And while most of the units we evaluated met the desired features of speed, accuracy and capacity, the larger scale printers require such a volume of material to fill, any "versatility" in materials seemed challenging both from a production and cost perspective. And let's be honest, cost/price will always find a way into the evaluation and decision! With 3D printers ranging from \$24,000 to over \$200,000 and start up material cost from \$150 to over \$10,000, it obviously takes much consideration of your laboratory needs, printer capabilities and cost analysis to determine your return on such an investment and what printer fits your needs.

#### How We Decided

Armed with all the information and having evaluated each printer's individual features, we determined that to fit our growth plan, we would start with a smaller unit that was open to different materials. Following this path would

- allow us to integrate 3D printing into both
   Fixed and Removable areas in our laboratory
   without extreme capital expense
- give us the opportunity to become familiar with the technology
- define how 3D printing could support our laboratory advancement and productivity.

We felt the Asiga Pro 2 from Whip Mix met the needs of our initial 3D printing requirements for a multitude of reasons, not only the printer capability but also training, support and location. With our lab being located in Louisville, KY, less than 5 miles from Whip Mix – the cornerstone of Dental Laboratory Materials- it made perfect sense to partner with them on this new technology...who better understands the needs for accuracy in dental materials?

### **Derby Dental Lab**

### The Integration

The integration of the printer was seamless into our production as our CAD Team members were already efficient with the digital workflow of receiving IOS files and 3Shape Model Builder. Adding the printer in-house in fact enhanced the workflow by reducing the "down time" of waiting to receive models from the outsource partners we had been working with. Additionally, the software component of the printer is very user friendly and has proved to be very easy to learn for our technicians, allowing them to effortlessly transition from CAD design technician to printing technician throughout the course of the day. For the first month of integration, we continued to order outsourced models as well as print in-house. This gave us the ability to compare and qualify our printed models. We found the models from our Asiga Pro 2 were equal to, if not slightly better, than some we were outsourcing and determined that our restorations fit consistently on both sets of models. This gave us the confidence to move all our model printing in-house without compromising the consistency and quality our IOS accounts had become accustomed to.

both Fixed and Removable casework, since purchasing the Asiga printer in March 2017. We have printed Surgical Guides and Splints with encouraging results, however the printer stays busy building models, so we already see the need for adding a second unit to our equipment line in order to take advantage of the versatility of materials currently offered through Whip Mix. You can't open a trade journal today without seeing a new printer or printable material for our industry and we feel confident, based on our success with the Asiga Pro 2, that Derby Dental Lab is poised to move forward with this technology and continue to grow our printed product portfolio.



Photo Credit: VeriModel OS resin, Whip Mix Corporation

#### Our Future with 3D Printing

Today, we have over 40 digital accounts and have processed nearly 500 digital models in-house, for

# Atlanta Oral & Maxillofacial Surgery

### Our CAD CAM History

Our facility is a surgical center that has been providing specialty surgical services since 1990 with the latest in technological advancements. We routinely use 3-dimensional x-ray and Trios intraoral scanners to promote the advantages of dental implants. We also scan approximately 5 – 6 patients every day for temporary teeth, custom abutments, study models, ortho models, surgical guides and flippers. Because our lab is on the premises is very small, we look to technology to help us turn out the amount of laboratory work that is needed.

### Lab Profile



Author: Larry Thompson Location: Alpharetta, GA Lab Type: In-house laboratory No. Employees: 1

# **Atlanta Oral & Maxillofacial Surgery**

### Deciding to Purchase a 3D Printer

The Dr. and I decided that we needed to start looking into 3D printers some time ago, since we thought they would be useful for our orthognathic cases and for printing surgical guides, but I don't think we ever imagined that a 3D printer would become so critical to our practice. Not only do we use it for models and surgical guides, we also print surgical splints for the orthognathic cases and bite jigs for full edentulous implant cases. Basically, we print anything that we can that will help us in surgery.

#### How We Decided

An important aspect of integrating technological equipment and digital software seamlessly is to have someone in the lab capable of understanding the use and programming and is fairly tech savvy. In our place, it's me, a dental technician. Since I'm "good with computers", I manage just fine.

Cory Lambertson, one of the technical support people at Whip Mix, and I figure out any issues we have going on. I would say it is important to at least have someone who can do an initial diagnosis of a problem to help in communicating with technical support personnel. This someone has to have at least a rudimentary knowledge of how 3D printers work so the parts can be supported correctly and not fail. Who in your lab is the right person? The actual learning process is easy. The software is easy and intuitive enough that just about anyone can learn to use the printer.

- Capacity Having an Asiga Pro 2 printer inhouse means not having to wait for another lab to print all of the parts we need. This helps us greatly. Being able to print a guide overnight and be ready to use the next morning is also great.
- Cost Cost is relative. For us, the benefits
  of having the larger unit far outweighs the
  cost. At first we did not think that we would
  use it as much as we have been. Now we are
  grateful that we purchased the larger Pro 2
  Asiga unit.

Our material/use costs are pretty low, too. Ortho models cost about \$10 per arch. Surgical guides only cost us between \$2- \$5, depending on the size and complexity. Ortho splints approximately \$3. Considering the low cost, I usually print 2 splints per case, so that if we somehow break one, we have a backup during surgery.

# Atlanta Oral & Maxillofacial Surgery

### Our Future with 3D Printing

All in all, the process of researching, purchasing and training on the Asiga printer was a painless one. Its usefulness in our day-to-day work has passed even our wildest expectations. It has been a very good experience and we expect to use it with present and future materials and applications for a long time to come. We would recommend it to any laboratory.



Photo Credit: Atlanta Oral & Maxillofacial Surgery

### **Fager Dental Lab**

#### **Our CAD CAM History**

We were early adopters of milling technology for pressing/casting and were recognized by major companies for our achievements. They became very interested that we had worked out a complete digital workflow early on while most labs were still hand waxing. They could not believe the increase in our "numbers" (the amount of materials and supplies we were buying from them). On our side we made improvements gradually to understand and utilize the technology to produce high quality restorations. This was a major step forward years ago, but not without peril. Clients and employees had pre-conceived notions about what technology could do, both good and bad. The point of this introduction is that because we had the technology in-house rather than outsourcing (which might have been more cost effective initially), it allowed us to refine our designs, settings and work flow quickly. Being nimble in a competitive market is a huge advantage.

### Lab Profile



Author: Charles Fager, CDT Location: Camp Hill, PA Lab Type: Crown & Bridge Dental Laboratory No. Employees: 6

### **Fager Dental Lab**

Using operation management methods, I determined that at certain volumes, printing patterns could be more efficient than milling. We had a small printer for castable copings and pressable full contour units. It was used to free up the mill for more zirconia. The printer had limitations, but let us become familiar with 3D printing technology. It was simply a step to purchasing a second mill. Any printed models that we needed were subcontracted to various outsource companies. I was never happy with the quality, expense and time for models to be received. Large format printers at that time were really only good for models that were not precise and not cost effective. We did not receive many digital impressions and lacked confidence in the workflow. Not having control of the printing process or material was very frustrating and did not help us to get more digital work.

#### Deciding to Purchase a 3D Printer

A turning point for us was deciding we would buy another printer a few years ago, when a major implant company developed a validated intraoral (IO) work flow for implants. All of our implants had a lab-based digital workflow anyhow, so it was a natural progression. The company that printed the models for us produced the best quality that I had ever seen. This was the new gold standard of printer material and performance. I thought that if I could find a printer that could deliver the material and precision we were looking for, without the issues of outsourcing, I would purchase it. None of the contemporary printers could come close to what I wanted. I paid for many samples and most of them disappointed me. We even milled some of our own models, but that held up the mills and the materials were horrible. There were new companies that had less expensive desktop printers, but their specifications and materials simply did not add up. They had proprietary materials and, despite their claimed specifications, produced poor results.

#### How We Decided

I presented this dilemma to Chris Frye at Whip Mix and he said they were evaluating the same process. He was the first person that actually listened to what I was saying and recognized my needs.

### The Integration

About a year later Chris and Sherri called me concerning a new printer they were working with. They printed some samples. After evaluating basically every printer on the market, I knew this was the one. I almost didn't want to share this information because I think it is one of the most significant advantages that a digital laboratory can have. The Asiga Pro 2 has performed very well and has let us refine

## **Fager Dental Lab**

implant and digital model workflows that would have been impossible without actually having this printer. We can efficiently print models from every major intraoral scanner and implant company. This has enabled us to retain clients that would have gone elsewhere, and it has attracted many others. We make our clients' investment in intraoral technology work!

Every laboratory will have different goals for their printer. Some will print:

- Castable partial frames
- Models
- Surgical guides
- Trays
- Castable copings

Whatever your 3D printer needs, the Asiga is versatile and can be adapted to the specific work flow that is ideal for your laboratory. Whip Mix has a proven record of working with dental laboratories and understands our needs. They have had to change as much as we have, and have made the commitment to succeed.



Photo Credit: Fager Dental Lab



Photo Credit: Fager Dental Lab

# Gain Expert Advice on How to Integrate 3D Printing into your Dental lab

Still have questions about which 3D printer is right for your lab?

Request a free consultation with one of our Sales Representatives







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