

Editorial

The Digital Dental Laboratory

We have seen hugely significant changes in the way dental laboratories operate due to the introduction of digital technologies based on Computer Aided Design and Computer Aided Manufacture (CAD-CAM) both in terms of data acquisition, processing and manufacturing. Only a decade ago, CAD/CAM-milled restorations made up an average of 4% of crown and bridge workloads; now that average is more like 50% and rising rapidly. It won't be long before every dental laboratory will have a model scanner and will also be able to accept digital images from intra-oral scanners. Although at present there is a reluctance amongst dental professionals to adopt intra-oral scanners, yet they acknowledge that digital impressioning is the future. Thus we can expect the uptake of intra-oral scanners to accelerate as more experience is gained with this new technology and confidence in its use grows. Of course, once a digital image has been created, it is obvious that any processes further down the line will be focused on digital data manipulation and digital manufacturing. It is not unreasonable to suggest that within the next five years the bulk of production of dental prostheses will be carried out by digital routes.

The digital work flow for dental devices relies on an integrated system of digital data acquisition, data processing and advanced manufacturing.

Data acquisition

At present the collection of patient data for the construction of crowns and bridges, is done by taking an impression. The process of taking an impression, cleaning and disinfecting the impression, pouring a model, digitizing the model and then storing the original model can be sidestepped with the use of an intra-oral scanner as this provides the digital model directly from the patient. The process of impressioning for crowns and bridges will thus be faster, more comfortable for the patient, involve no retakes, no cross infection issues and result in a saving in materials. For orthodontic purposes a digital model for storage and retrieval is often all that is required and an intra-oral scanner will simplify the acquisition and storage of models.

Data processing

There are already a large number of software packages available for the design of crowns and bridges. With an increased uptake of digital impressioning, the demands placed on this software will increase and so we can expect major software developments. The software has already been extended to include partial denture design capabilities and customised implant abutments. With ongoing research on developing, a digital articulator for the edentulous patient it won't be long before we see the first software packages coming onto the market for the design of full dentures too.

Manufacturing

At present the digital manufacturing of dental prostheses is dominated by computer aided machining (CAM) and there are milling units that can dry mill or wet mill in a wide range of materials. Thus we have the capability of dry milling monolithic restorations in zirconia or composite resin. Wet milling units allow us to extend our CAM capability to include glass-ceramics such as the leucite feldspars and lithium disilicates.

The latest approach is to use 3D printing technologies and these will have a profound impact on manufacturing. We already have the capability to wax print frameworks, which can be cast using the traditional lost wax casting process. A technology that is beginning to impact on dental prosthesis manufacture is direct metal laser sintering (DMLS). I predict that DMLS will be the way forward in producing metal parts and before long casting and milling will be considered old fashioned. A number of companies now produce DMLS units designed specifically for the dental market. Some of these can fit on desk and are able to print up to 40 crowns and bridge units in a single printing operation. Thus, it is fast and efficient with a unit cost

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that is considerably less than that using traditional casting. There are now a number of companies that provide a 3D printing service for Co-Cr crown and bridge and partial denture frameworks.

It is vital that Dental Schools become fully engaged with these new technologies. It is only through having access to and direct experience of the latest technologies that Dental Schools will be able to understand the strengths and limitations of these technologies. Especially with regard to 3D printing, the developments are driven by the needs of the aerospace and automotive industries. Only by the dental profession, and in particular clinical academics, being actively engaged in research and development will these new technologies deliver what we need for our patients.

There is the added benefit that those versed in digital dental technologies can provide guidance to dental professionals as new materials and technologies appear on the market and give both undergraduate and postgraduate dental students the best possible experience that prepares them for general dental practice.

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