Module 6: Dental Technology and Laboratory Procedures

The sixth module in the BDIA Certificate covers the role of the dental technician and dental laboratories in supporting dental practices.

Technicians provide a range of services; mainly the production of fixed (crowns and bridges) and removable (dentures) prosthetics supported by implants or natural teeth/gingivae, but also in more specialist areas such as orthodontics and maxillofacial reconstruction.

Traditional "false teeth" (full dentures) are the mainstay of many dental laboratories, and are often made using pink and tooth-colours plastics called acrylics (although the artificial teeth can also be made of a range of more durable materials). The artificial teeth are supplied as mould-in small sets, which can be chosen to suit the clinical situation at hand, as well as the budget.

As most dental laboratories are separated from dental clinics, often tucked away in industrial estates or side roads, and as the construction of the prosthetics occurs outside the mouth, a replica of the patent's intraoral situation needs to be constructed via a dental impression. This is often done using impression materials, though intraoral scanning is slowly starting to replace this.

Impression materials can be alginates, silicones or polyethers. The choice of material will depend on the procedure being conducted. Alginate is less accurate, but cheaper, and suitable for dentures and orthodontics. They all work in much the same way, being a viscous liquid added to an impression tray that fits inside the mouth. The impression material sets in a few minutes, after which it can be removed, disinfected and sent to the laboratory. This process creates a "negative" copy of the patient's mouth. Once in the laboratory, this negative is made into a "positive" using plaster (or directly scanning the impression to create a digital positive).

Full dentures

In making full dentures, the technician will create wax bite blocks which the dentist will use to record the occlusion within the patient. The technician then uses this bite block to set the plaster models into the correct position using an articulator (a device that replicates how the patient's jaw opens and closes).

Wax try-in dentures are made using the actual acrylic teeth and fitted into pink wax for a trial fit in the patient. After adjustment, the amended wax try-in is processed by replacing the pink wax with pink acrylic. There are a number of ways in which this can happen.

Partial dentures

These are similar to full dentures, but can incorporate metalwork, to help slip them into place around natural dentition, or a metal framework. Metal frameworks are normally made using chrome cobalt. If metalwork is involved, the "lost wax" technique is often employed.

Crowns, bridges and veneers

Typically crowns and bridges would be made with a metal substructure (coping, made via lost wax) to give strength, with a thin layer of porcelain over the top for aesthetics. This is commonly called porcelain-fused-to-metal. Veneers are a thin layer of tooth-coloured material bonded to the surface of non-load bearing teeth (the tooth surface is prepared by removing a thin layer of enamel).

Crowns and veneers may also be made of glass ceramic materials, which are aesthetic but not strong enough to take chewing forces.

Crowns and bridges may also be made from zirconia, a high strength, aesthetic material that can only be produced using CADCAM technology.

CAD/CAM

Increasingly, dental laboratories are adopting CAD/CAM technology. CAD/CAM is an engineering term that stands for computer aided design/computer aided manufacturing. The CAD aspect involves the design of a restoration after digitisation of the case (either

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by scanning with an intraoral scanner in the dental practice, or scanning an impression or the plaster model within the lab with a CAD/CAM scanner). Once the restoration has been designed, the CAM aspect takes over, where manufacturing is conducted by machine using a wide range of materials. The manufacturing can happen in a number of locations, either in the laboratory, a neighbouring production centre or a large-scale manufacturing site which could be many miles away. Technology even exists to produce components within a dental practice, scanning, designing and producing within one practice in a day.

The capability of CAD/CAM technology is improving constantly and is arguably the fastest developing part of dentistry.

Implantology

Implants can be used to help stabilise dentures, or to provide crown and bridgework for smaller gaps, without damaging surrounding teeth. An implant is a small, normally titanium, screw that is placed in the jaw bone to act as an artificial root. Typically, implants offer a better quality of life and a natural and aesthetic appearance that leaves other, healthy teeth intact.

Implant placement is a surgical procedure that requires additional, post-graduate training by a dentist. Once an implant has osseointegrated (knitted into the bone), an impression can be taken using specific components fixed into the implant to register the position of the implant in the impression. Once at the dental laboratory, and implant analog is fixed into the plaster model to replicate the implant in the patient. The dental technician can then use this to select the correct abutment (the component that links the implant to the new crown, bridge or denture).

Orthodontics

In orthodontics, dentists are correcting misaligned teeth. This may be caused by overcrowding but can be caused by tooth gaps, damage or genetic factors. In the UK, one in three children have misalignment that requires treatment on health grounds and a further third could benefit from an aesthetic perspective.

Correction requires the use of orthodontic appliances which add pressure to teeth to guide them into the correct position. Mild aesthetic orthodontic treatments can be conducted with functional appliances (a type of modified mouth guard) from a number of manufacturers. More involved treatment can use removable appliances (like a plate that fits the roof of the mouth with wires and springs to put pressure on teeth). However, extensive orthodontics involves the use of braces (fixed appliances, using brackets and wires). Fixed appliances are able to tip, rotate, or torque teeth – essentially to move them in any direction. Traditionally made of metal, more aesthetic plastic options are now available. The fixed appliance will remain in the mouth for many months, or even a few years, with regular adjustments being made every six to 10 weeks to continue the movement of teeth into the desired position.

Clinical dental technicians

Since 2008, dental technicians have had the chance to upskill to become clinical dental technicians, which enables them to work directly with fully edentulous patients after an initial referral from a dentist.

The maturing digital landscape

Vicken Hatsakordzian discusses the the rate of adoption within the dental market.

Digital dentistry has arguably been the biggest advancement for dentistry over the past decade, and it's an exciting time to be part of what I see as a maturing digital landscape. As the topic of digitisation continues to grow in importance, establishing itself throughout the dental industry and gaining momentum, it's beginning to change clinicians and dental technicians working lives for the better, doing away with more routine tasks and allowing them to benefit from optimised digital workflows and maximum flexibility and productivity.

I'm convinced that the dental future is digital, however, some might argue that the pace of new technology adoption is not accelerating as quickly as the production, despite the apparent benefits. From a trend perspective and if we consider Rogers' bell curve, then it's evident we all approach innovations in our own way. Can you recognise yourself in this list?

The innovators – The early days of digital dentistry saw the innovators rise to the surface, those who would pay any money to get their hands on the first digital systems on the market, regardless if the technology was properly ready for market or not. According to Rogers, it's likely only a small 2.5 per cent of the market would have taken a risk to adopt new technology at this stage.

The early adopters – This group (approximately 13.5 per cent of the market) are more socially apt, often key opinion leaders, and ready to utilise the new innovation as a means to maintain communication with the industry.

The early majority – After waiting a few years, having listened to what the innovators and early adopters had to say and holding back slightly until early glitches were ironed out, we saw this demographic take the leap into digital.

The late majority – Now, we are seeing the rise of the late majority, those who waited to see where technology was going and are now purchasing hi-tech equipment such as CAD/CAM, CBCT, lasers and in-house milling systems at the very least.

The laggards – The final element to Rogers' bell curve, these people are the last to adopt new innovations and usually have an aversion to change. With a tendency to be more traditional in their processes, it is this group that make us ask, is going digital a necessity?

Future innovations

Today, we're finding that dental professionals are predominantly interested in our digital innovations, eager to find out about the efficient, and at the same time easy processing, methods available to their laboratories and practices.

We have excellent platforms in terms of digital hardware and software that we can readily build upon. Scanners and milling machines are well-established and now is the time for manufacturers to improve on these and see how far they can be pushed to do things in a faster and even more productive method.

Alongside this, I predict we will see new printing technology take its place alongside scanning. 3D printing has been slow to take off in dentistry, but as printers become more affordable this could be about to change. The current challenge for manufacturers is developing the materials needed to produce printed dentures for example, as all materials used in the mouth have yet to be approved and regulated by governing bodies in Europe and the UK.

Making the move

No one can predict the future of dentistry 100 per cent. For years, crowns, bridges, restorations and prosthetics have been made in a traditional way that has been very successful, but now we have new ways of doing things that are faster and more efficient, using new equipment, products and materials. Just as we moved from VHS video recorders to HD digital recorders and CDs to digital

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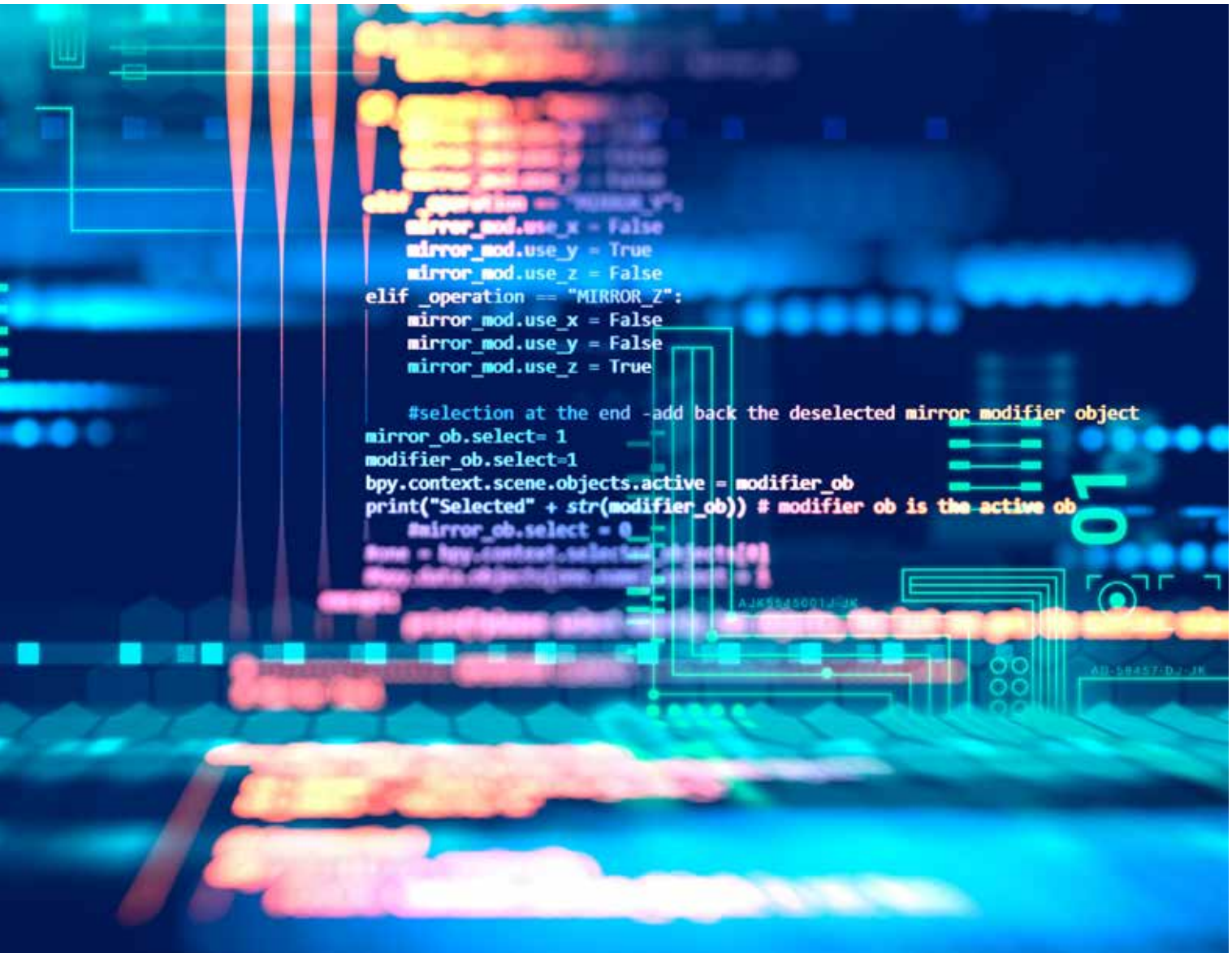

downloads, the technology is now here to make prosthetics in a new and improved way; this is becoming the normal way of doing dentistry rather than the analogue methods we have been used to in the past.

Educational institutions also have a part to play, recognising there is a digital revolution happening and starting to teach students the digital side of the business. Hopefully, now, when any student leaves university, it's no mystery to them how CAD/CAM works. We're in a transitional time in digital dentistry and, as analogue methods gradually disappear, things will be very different for the next generation of technicians in a digital world.

Conclusion

As is the case in many areas of our lives, the need to accomplish things at a consistently faster rate and higher standard with as little effort as possible is increasing. Growing expectations with regards to efficiency, and in our industry aesthetics, must be met with products and processes that comply with rising standards in terms of their reliability in particular.

In the dental industry, the keywords in this context include process safety and reliability as well as the predictability and reproducibility of results. Consequently, digital dentistry workflows that focus on ensuring easy and comprehensible processes, selecting materials and designing and producing restorations, have become indispensable. The dental industry is compelled to further develop digitalisation for the benefit of users and patients.■