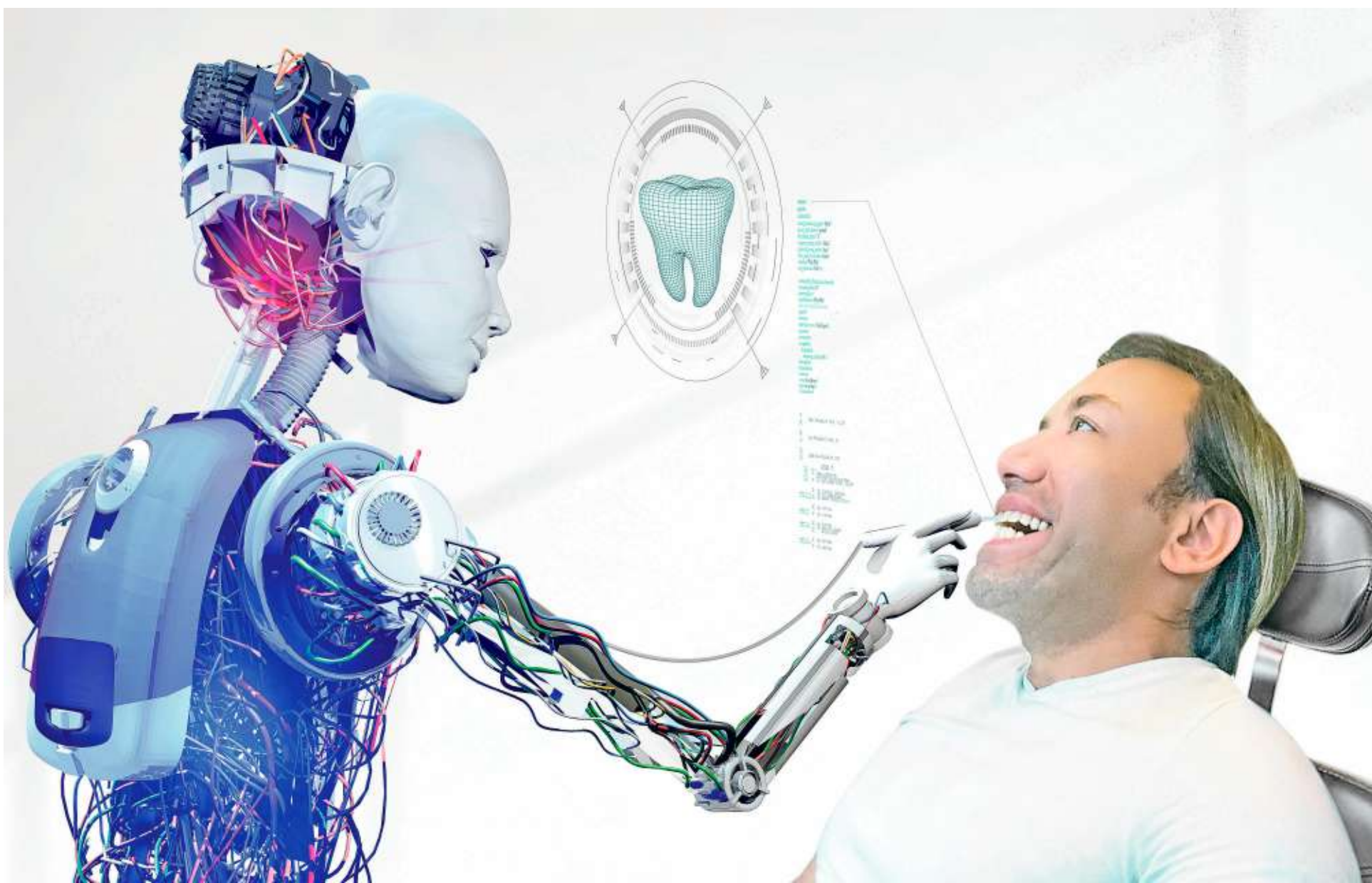


Innovation in Dentistry



How technology is facilitating wider smiles

Danielle Barron

Strides in orthodontic wiring and digital imaging help both professionals and patients

It goes without saying that advances in technology mean the way we bank, shop and run our homes has changed irrevocably. Modern dentistry has not

been immune to this paradigm shift and advances in technology have changed the face of modern orthodontics (pardon the pun). Not only have orthodontists become more efficient at achieving better outcomes, at the same time, treatment burden has been reduced, positively influencing patient compliance.

Dr Ciara Scott practises at the Blackrock Clinic and is the current president of the Orthodontic Society of Ireland. In the two decades since she began training in specialist orthodontics, she has observed a shift in healthcare towards patient-centred care that engages patients and parents in their own care. "The wealth of information on

the internet and range of treatment options means some patients come to us with a lot of information and questions. This time spent with a patient before any treatment starts is still the most valuable way to ensure they are choosing the right appliance for them." Covid served to heighten the public's awareness of "trusted sources" and quality information, she adds.

According to Scott, the emergence of digital imaging techniques has "transformed" orthodontic care.

"This makes it possible to look at all the digital diagnostic images and photographs together, listen to patients' concerns, discuss a range of appliance options and agree the

treatment plan together," she explains.

But while digital transformation has guided disruptive innovations to build a "new better", Scott says the increasing trend for orthodontic treatment to be marketed "direct to consumer" without a physical examination or direct supervision of care by a registered dentist or orthodontist led the Dental Council of Ireland and other international bodies to issue specific advice on this for patients and the profession. "Patients should know the name and qualifications of the orthodontist responsible for their care," she says.

Dr Christine Smith is the private practice representative for the Orthodontic Society of Ireland, as well as being a specialist orthodontist at Navan Orthodontics in Co Meath. She explains that the biggest shift in orthodontics in the last 20 years has been the development of gentle, flexible wires for use in conventional braces or train tracks, and the arrival of clear aligners such as Invisalign. "Both of these advances make orthodontic treatment a far more comfortable and rewarding experience," Smith says.

Technology and digital software have also allowed for better communication with patients. "Photographs and X-rays can be viewed immediately, and 3D scans of your teeth can be done in minutes. All this helps with patient education and their understanding of their teeth and bite, and what treatment can be done to correct it," she explains.

More complex

Unsurprisingly, the increasing variety of treatment options has made the job of the orthodontist more complex, she adds; key to this is diagnosis and treatment planning which stems from a full face-to-face clinical examination with the patient and careful analysis of digital scans, photographs and X-rays.

"It should be said that whether it be braces on the inside or outside of your teeth or aligners, these systems are only as good as the orthodontist using them," Smith notes.

Echoing her colleagues, Smith says compliance is key when it comes to getting better results. "Obviously, the communication between the orthodontist and patient lays the foundation for any course of treatment. This is especially the case when the patient realises that a quick fix is not likely to leave them satisfied with their smile and their end result." This is where technology such as treatment simulations can be a "remarkable visual tool", she adds. "This allows the patient to see a virtual simulation of their predicted outcomes."

Although Scott dislikes the

word "compliance", she agrees that highly motivated patients get the best results. "We get our best outcomes from our best patients." She studied at the RCSI Centre for Positive Psychology and Health last year to learn how to have better conversations with patients to improve treatment outcomes and health. "This will be the next big area of growth, using technology to support self-management before, during and after treatment."

Teenagers and apps

This is critical, says orthodontist Dr Finn Geoghegan of Specialist Orthodontic Practice in Glenageary in south Co Dublin. Geoghegan uses an innovative system called dental monitoring, which employs AI to deliver a regular progress report to both orthodontist and patient. Patients use a special app to send in photographs of their teeth allowing for remote monitoring and fewer visits to the orthodontist for busy teenagers (or adults).

"The reality is that you are dealing with a very tech-savvy generation for whom this fits into their everyday lives. These methods are familiar to them

“What this artificial intelligence is doing is enhancing what your orthodontist can offer, not replacing it. The core skills of the specialist orthodontist are still the same

from how their lives have changed," Geoghegan says.

With patients more likely to comply with orthodontic treatment as a result, this means brighter smiles all round. "It promotes greater engagement from the patient's point of view, and a lot of our treatment is based on their motivations. If they are 12 or 13, and they can see how their smile is developing on their phone, they can track their progress and see how things are getting better and they will keep going."

It works both ways, he adds: "Reviewing your patient virtually means you can see what level of priority they need. If I see things aren't going great, I can bring them in."

Geoghegan says that while members of the profession – and the public – may have initially been dubious about technology-driven orthodontic practices, it is swiftly becoming the norm. "What this artificial intelligence is doing is enhancing what your orthodontist can offer, not replacing it. The core skills of the specialist orthodon-

■ **The emergence of digital imaging techniques has transformed orthodontic care**

tists are still the same."

Technology has undoubtedly enhanced orthodontic practice, but Scott stresses that the appliance has not supplanted the orthodontist in the delivery of high-quality orthodontic outcomes. "Orthodontists understand the biology of tooth movement and how long treatment takes depends on this movement. Suggesting a device is quicker or simpler than 'traditional' treatment is often just persuasive marketing," she warns.

Teledentistry now a viable option for those in need

Sandra O'Connell

The shift to digital during the pandemic was most evident in the rise of home working and online shopping. It also moved telemedicine mainstream as during lockdowns many of us got used to seeing our GP online via the screen on our mobile phone.

Teledentistry also began to emerge as a viable option for certain scenarios, says Bevin Mahon, managing director of Dental Tech group. The family business is a leader in denture and dental treatments nationally, thanks in no small part to its early adoption of innovative technologies.

Mahon believes, for example, that the firm was the first outside of north America to scan and 3D print dentures.

Unlike braces, veneers and even implants, dentures are rarely talked about. "Dentures is not the sexy side of dentistry. No one wants to talk about it, even though one in three over 35-year-olds in Ireland is missing one or more teeth," she explains.

Her practice has developed a specialist service which helps people to instantly plug those gaps, using state of the art technology that scans the mouth and develops a small plate that clicks into place instantly.

"So many people have lost a tooth through sports, an accident or as a result of pregnancy, and we are the expert gap fillers," she says.

To meet demand for their ser-

vices during Covid, it introduced a teledentistry service, including as part of its work partnering with Dental Care Ireland, a growing network of dental practices around the country. It offers a full range of general, specialist and cosmetic dental treatments, from check-ups and cleaning to teeth whitening and implants, including denture services.

"With teledentistry there is no commute and no time waiting in a waiting room," says Mahon. "Instead you get your 30-minute appointment, log in at the appointed time, and that's it, done."

After-care situations

After that, there are three outcomes. "One, you are fine and you get peace of mind. Two, you get a prescription for infection sent straight to your pharmacist, which gets you out of pain fast. Three, you come in for a follow-up."

Teledentistry is highly effective too for after-care situations such as where, for example, a root canal specialist makes follow up calls in the days after a procedure has been undertaken, to ensure all is well.

With people spending more time working from home, often far from the urban and suburban centres where their dental practitioner is based, demand for such services is only likely to grow.

"They're great for all those consultations where you want to talk to a dentist about something, like whether or not you need a crown, but don't want to spend two hours commuting in the car," says Mahon.



■ **'So many people have lost a tooth . . . we are the expert gap fillers'**

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‘People have made the connection between teeth and general health’

Sandra O’Connell

Demand is up for adult braces, teeth whitening, straightening and veneers

“The early days of the pandemic caused fear and consternation for both dentists and patients alike. Few lines of work were less conducive to social distancing or more susceptible to an airborne virus.

The vaccine changed all that. “Initially with Covid we all worried it might be the end of dentistry, but it’s gone the other way,” says Dr Morgan O’Gara of Blackrock Dental in Dublin.

“Now everyone [in the field] is out the door busy and not just because of a backlog, but because people have become more health conscious generally, as a result of Covid, and have made the connection between teeth and general health. The mouth, after all, the pathway to the inner body.”

There is one other big factor driving demand: Zoom.

Almost 18 months of working from home has given us all a new perspective on our gnashers. “All those Zoom calls left people looking at themselves in a little box up on screen for up to seven hours a day,” says O’Gara.

He only came across the video service because so many of his patients told him it was what prompted them to come in.

Unlike a mirror, for which people usually adopt their best pose, talking on video camera gave them a whole new perspective on their teeth.

On top of that – literally – came masks. For some of his patients, the wearing of masks while out and about provided them with good cover for work on their teeth, in particular braces.

The stigma of adult braces is more than gone. If anything, he suggests, they are almost a status symbol.

“However, working from home and wearing masks going out encouraged some people to think now is the time to do something they’d been planning for ages,” he says.

The most common cosmetic treatment currently sought out is teeth whitening. Teeth have a naturally yellow tint which gets more pronounced as we age. Too white is not a good look, and a good practitioner will steer you away a shade liable to dazzle hh motorists.

“Teeth whitening today is about bringing them up just a couple of shades. You get gumshields made for you, apply the whitening gel at night over two weeks. It’s simple and easy, and you look healthier and younger,” he says.

Straighten up

Next comes demand for straighter teeth. Today much of this demand comes from



adults who wore traditional “train track” braces as a teenager and, as is the teenager’s wont, stopped wearing their retainers as soon as their parents stopped banging on about the thousands of euro forked out for their teeth.

This particular cohort is disinclined to go back to wearing train tracks. However, the advent of clear aligner alternatives has prompted many to remedy the situation. These kinds of aligners – though much the same in terms of cost – sit on top of your teeth, aren’t immediately obvious to observers, and can be removed while you eat. Crucially, they can get the job done in six to eight months.

Innovations in this area also include at-home aligner treatments. Therapie Smile, which has a number of clinics around the country, provides at-home treatment times of just 20 weeks, for suitable candidates.

Innovations such as these are in part why aligners are now so prevalent. “We’re

providing them to everyone from teens to people in their 70s,” says O’Gara.

However, he prefers to opt for traditional fixed braces for teenagers, simply because that age group is more likely to succumb to the temptation to take them off. Also, you can’t leave your train tracks on the train.

If your teeth are where they should be, but gaps exist, there are a variety of options, starting with composite resins that a dentist can mould and shape to fill a chip here, or an unevenness there.

The next step up is a veneer, a thin, tooth-coloured shell that sits over the front of the tooth to improve its appearance. These can be made from resin composite materials or from porcelain, which looks more natural and can resist stains better than resin veneers.

“Porcelain gives us the best aesthetic results. It’s a beautiful material and works very well for old, discoloured teeth, or teeth with fillings or which have an old ve-

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Working from home and wearing masks going out encouraged some people to think now is the time to do something they’d been planning for ages

neer here and there. It can give you brilliant results,” he says.

Again, not too brilliant. “What gives porcelain a bad name is what I call Turkey Teeth, where people go abroad to get a job done and come back with ultra-white teeth that are often too long,” he says.

Just as you don’t want people complimenting your make-up, but rather how good you look, “Good veneers are the ones you don’t know about”.

Dental implant

For teeth that simply have to go, or are lost in an accident, the dental implant is the gold standard, and the closest thing you’ll get to a natural tooth.

Perhaps the biggest innovation in dentistry in recent years is that so much of the preparatory work now is done digitally. “The digital side of things has changed things dramatically. All the making of moulds and feeling like you’d gag, that’s all gone,” he says.

■ **People have become more health conscious generally, as a result of Covid, and have made the connection between teeth and general health. The mouth, after all, the pathway to the inner body**

New software is even being developed which can scan teeth and use predictive technology to indicate the likely progress and impact of wear and tear, to prevent issues down the line.

Digitisation has helped with implants too, enabling the dentist to know much more precisely where to position the implant to avoid nerves. “It makes it safer and more predictable,” he says.

The use of photos and digital scans means dentists can work with a lab to achieve a ‘trial smile’ virtually before embarking on the work.

“It takes the unknown out of it for the patient,” says O’Gara, “so you can go on that journey together.”

Technology that will shape the future of dentistry

Danielle Barron

There are many developments on track to maximise your smile

In ancient times, dentistry was invariably a barbaric experience – think tooth drilling with no anaesthetic. Fast forward thousands of years and people are still afraid of the dentist, but new techniques and technologies are continually making the time spent in the dentist’s chair quicker, smoother and even more painless.

From AI to smart toothbrushes, augmented reality and virtual reality, we look at the new technologies coming down the tracks that promise to finesse your smile and maximise your dental health in the years to come.

‘Smart’ electric toothbrush

If your TV and fridge can be smart, then why not your toothbrush? These gadgets connect via Bluetooth to an app where you can track how long – and how well – you brush those molars.

This is achieved via tiny sensors in the handles of the brush which detect the brush’s position, while others may have pressure sensors, letting you know when you are brushing too hard. But these are expensive pieces of kit and the jury is out on their relative effectiveness.



■ **3D printing is making dental implants and aligners more affordable** PHOTOGRAPH: ISTOCK

Dentists have been slow to recommend them, saying proper brushing technique is far more important.

Artificial intelligence

Far from being futuristic, AI is now firmly embedded in dental care, particularly in orthodontics.

Here it is being used to aid diagnosis, using genetic algorithms that aid in predicting sizes of unerupted teeth. In terms of treatment and follow-up monitoring, it makes virtual models and 3D scans a possibility, making aligners more precise than ever and allowing for unprecedented, tailored treat-

ment plans.

Efforts are now being made to link AI with imaging techniques such as MRI so that even the tiniest shift in normal structures can be identified, making for a perfect result.

3D printing

Costly dental implants, aligners and other dental apparatus are set to become far more affordable thanks to 3D printing.

The technology offers a cheaper way to create dental tools such as splints, used to prevent tooth grinding. Heretofore, lost or broken splints meant the slow and costly creation of replacements, with a

new mould having to be taken of a patient’s mouth.

Now with 3D printing, new splints can be produced in a matter of hours. 3D printers have also been used to produce dental implants for a fraction of the cost.

It all adds up though – the market for dental 3D printing is set to reach more than \$12 billion (€10.35 billion) by 2028.

Augmented reality

It may be an emerging technology, but dentists are already using augmented reality to great effect.

The same technology that your social media apps use to

create funny filters for your photographs is now being used in both reconstructive and aesthetic procedures in order to help patients know what they will look like once their treatment is completed.

Long before a patient sets foot in the dentist’s surgery, they may be able to use their phone to decide exactly how they wish their smile to appear in real life.

Virtual reality

Virtual reality (VR) headsets are being worn by dental patients to provide digital distractions – studies have already shown that patients report a significant reduction in their perceived pain when distracted in this fashion.

VR is also used in training to allow dentistry students to digitally experience dental procedures from a distance, meaning they can gain specific experience in treating even rare cases.

Regenerative dentistry

Regenerative dentistry may offer an exciting alternative to dentures and other dental prostheses.

By stimulating stem cells to encourage the growth of dentin – the bony material that makes up the majority of the tooth – researchers in Nottingham University and Harvard University have developed “self-healing” teeth, allowing patients to effectively regrow teeth that are damaged through dental disease.

While the technique is still in its infancy, the inventors are hoping to partner with industry in order to make it more widely available.



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