Regional declaration on amalgam phase-out signed in Bangladesh

Asia poised to become first continent free from dental mercury waste

Dhaka, Bangladesh: Representatives of dental and civil society organisations in Asia recently signed a declaration in Dhaka, Bangladesh, that calls for a phase-out of dental fillings containing mercury throughout the region. The agreement also aims for the cease of trade in amalgam and to educate dental professionals about mercury-free alternatives, such as Atraumatic Restorative Treatment.

Use of amalgam in the treatment of children and pregnant women is to be prohibited already this year, the paper states. It also strives for developing measures to raise public awareness about the environmental hazards of amalgam and to help hospitals and dental institutions continent wide to provide mercury-free dental health care services. An overall phase-out of amalgam in dentistry in Asia is targeted for 2020.

The declaration was formulated last November in Dhaka. (Photo OSVSWA, India)

Signed by dental representatives from India, Nepal, Bangladesh, Thailand, Pakistan and Sri Lanka, the declaration is considered a practical step towards implementing the Minamata Convention on Mercury, an international agreement signed by over 87 countries two years ago in Japan that has banned the use of the hazardous material.

Dental icon dies at 85

The father of the modern dental implant, Per-Ingvar Brånemark, has died at age 85 in his hometown of Gothenburg in Sweden from a heart attack. He leaves behind his wife, three children and four grandchildren.

A physician and dedicated researcher, Brånemark accidentally discovered how to anchor titanium in bone, a process known as osseointegration, when studying the effects of blood flow on bone healing. He successfully placed the first titanium implant in the mid-1960s in a Swedish patient with several jaw deformities and missing teeth. His invention was approved by Swedish health authorities in the early 1970s. It is still sold today as the Brånemark system by Nobel Biocare.

During his lifetime, Brånemark received several honours, including the Swedish Society of Medicine’s Söderberg Prize and the European Inventor Award for Lifetime Achievement.

De John Williams and colleagues from the Colorado State University in the US demonstrating a device that could allow deaf patients to hear with their tongue. (Photo courtesy of CSM, USA)

Dentures pose health risk during sleep

Japanese researchers have found that people who wear dentures at night are at an increased risk of pneumonia. According to their study, patients who wore their dentures during sleep were at a 2.5-fold risk of developing the condition compared with those of a control group who removed their dentures before they went to bed. Denture wearers were also more likely to suffer development of tongue and denture plaque, Candida albicans, as well as periodontal inflammation.

The study conducted at the Nihon University’s School of Dentistry and Keio University’s School of Medicine in Tokyo examined 228 men and 266 women aged 85 and over in terms of their oral health status and behaviour.

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Distinguished by innovation

Brånemark was distinguished by innovation. His invention was approved by Swedish health authorities in the early 1970s. It is still sold today as the Brånemark system by Nobel Biocare.
While mercury-free dentistry is growing even in rural parts of India, Pattanaik said, more than 70 per cent of dentists in the country are still using it as their primary filling material. The widespread use results in 65 tons of amalgam waste per year, which, despite new initiatives to educate dentists about the benefits of amalgam separators, is released into the environment. It is then transformed into methymercury, a highly toxic form of the metal that poses health risks to wildlife and human beings.

“The large number of dental practitioners and dental professionals both in the private and government sectors are unaware of these things and required to be sensitised to avoid amalgam disposal through the normal sewer system,” Prof. Mahesh Verma, Indian Dental Association President and Director and Principal of the Maulana Azad Institute of Dental Sciences in New Delhi, told Dental Tribune Asia Pacific.

Religious practices like Hindu cremations further add to the environmental problem, as they release mercury from dental fillings into the air.

While the environmental effects of amalgam waste in Asia remain largely unknown, it is believed that the continent contributes significantly to the overall global burden. According to a 2015 report released by the United Nations Environment Programme, amalgam waste entering the solid waste stream amounts to 540 tons worldwide.

Total emissions of mercury resulting from cremation of human remains were estimated at 5.6 tons.
Study finds e-learning as good as traditional training for health professionals

LONDON, UK: Electronic learning could enable millions more students to train as doctors and nurses worldwide, according to the latest research. A review commissioned by the World Health Organization (WHO) and carried out by Imperial College London researchers concluded that e-learning is likely to be as effective as traditional methods for training health professionals. These new findings support the approach to continuing education Dental Tribune International (DTI) has adopted with its free online education platform for dental professionals.

The Imperial team, led by Dr Josip Car, carried out a systematic review of the scientific literature to evaluate the effectiveness of e-learning for undergraduate health professional education. They conducted separate analyses on online learning, which requires an Internet connection, and offline learning, delivered via CD-ROMs or USB flash drives, for example.

The findings, drawn from a total of 108 studies, showed that students acquire knowledge and skills through online and offline e-learning as well as or better than they do through traditional teaching.

E-learning, the use of electronic media and devices in education, is already used by some universities to support traditional campus-based teaching or to enable distance learning. Wider use of e-learning might help to address the need to train more health workers across the globe. According to a recent WHO report, the world is short of 7.2 million health care professionals, and the figure is growing.

The authors suggest that combining e-learning with traditional teaching might be suitable for health care training, as practical skills must also be acquired.

According to Car, from the School of Public Health at Imperial, “E-learning programmes could potentially help address the shortage of healthcare workers by enabling greater access to education; especially in the developing world the need for more health professionals is greatest.”

While the study focused on the education of students, DTI follows a similar approach to continuing education, offering webinars via its Dental Tribune Study Club, which it launched in 2009. The platform regularly offers free online courses in several languages. The wide range of topics includes general dentistry, digital dentistry, practice management, as well as specialties, such as implantology and endodontontology. The webinars are presented by experienced speakers and participants are awarded continuing education credits.

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Je suis Charlie

Daniel Zimmermann

A few weeks ago, this simple French expression brought people around the globe together in solidarity. Unfortunately, a dear friend of our French editor was killed in the terrorist attacks against the Charlie Hebdo newspaper on 7 January and a Jewish supermarket in Paris on 9 January.

Our thoughts are with her family and the bereaved of the other 15 victims.

What remains now after these horrific events? Obviously, there is the revealing fact that security, wherever you are, is an illusion. Barbaric acts of violence are not things that happen to someone else somewhere else; they can affect you directly and without warning.

Do we persist and go on or do we give in and play the game of the devil? My sincere hope is that, the devil? My sincere hope is that, whenever you are, is an illusion. Barbaric acts of violence are not things that happen to someone else somewhere else; they can affect you directly and without warning.

Our Group Editor, Daniel Zimmermann, speaks up for humanity and reason around the globe together in solidarity.

Yours sincerely,

Daniel Zimmermann
Group Editor
Dental Tribune International

Dental Tribune welcomes comments, suggestions and complaints at newsroom@dental-tribune.com.

For quick access to our contact form, scan the following QR code.

No place in clinical dentistry

Dr Sushil Koirala
Nepal

The use of mercury in dental restorative materials has a long history. While amalgam fillings are still popular among dentists in both developed and developing countries, the toxic effects of the metal remain a subject of controversy.

In my practice, I stopped performing tooth restorations with amalgam 15 years ago, not because of its toxicity, but because it is not a natural substitute and such restorations require more invasive tooth preparation. Now, we have various tooth-coloured adhesive restorative materials at our disposal as an alternative to amalgam. Therefore, its use in clinical practice largely depends on the mindset and choice of the dentist and patient. I personally believe that, if a dentist considers do no harm dentistry his or her practice philosophy and adopts minimally invasive restorative techniques to achieve natural-mimetic clinical results, then silver amalgam restorations no longer have a place in clinical dentistry.

When discussing banning mercury-containing restorative materials in dentistry, we must consider what we have been teaching our students at undergraduate level. If we carefully look at the restorative dentistry syllabus in Asia, we see that almost every dental department still teaches conventional restorative procedures with amalgam. They also focus on G.V. Black’s principles of cavity preparation, which are now considered very invasive and becoming increasingly obsolete in quality dental practice.

Unless we reconsider restorative techniques and materials science in dental curriculums, it will be difficult to induce practical changes in clinical practice.

As a practitioner and advocate of minimally invasive cosmetic dentistry, I have been effectively promoting tooth-coloured adhesive restorative materials. I strongly urge young dentists to perform minimally invasive and natural-mimetic dentistry for the long-term health and beauty of teeth and smiles.

Yours sincerely,

Dr Sushil Koirala is President of the Asian Academy of Aesthetic Dentistry and a regular contributor to Dental Tribune. Dr Koirala can be contacted at dsushilkoirala@gmail.com.

A man of humour and humanity

Dr Yatoro Komiyama
Nagano

When I met Prof. Per-Ingvar Brånemark in his workroom at the University of Gothenburg at the beginning of the 1980s, my introduction to him was not good. I was overly formal because I thought he would be difficult to approach. Luckily, he was not.

His heart was filled with benevolence for his patients. He always wore a smile and encouraged communication. “The optimal hardware and software are very important factors in order to establish osseointegration and to maintain it for many years. Minimal tissue violation is the most valuable factor of software,” this is the advice he gave me in 1982. I always bear it in mind.

During a lecture he gave in Dallas in 1989 as the first honorary member of the Academy of Osseointegration, he dropped the pin microphone. “Maybe I should install a tooth fixture in my rip to hold this mic,” he joked.

Brånemark was a genuine mentor to all dentists. May his soul rest in peace and watch over us for ever.

Yataro Komiyama is founder of the Brånemark Osseointegration Center in Tokyo, Japan, and Clinical Professor at Tokyo Dental College. He can be contacted at yataro@teabreak.jp.
Clinical governance—
A system for better health care

While accountability and improvement have been prominent in health care systems for quite some time, there is probably no other time in history when the relevance and importance of these have been more advocated. Learning from our shortcomings and improving our health care system towards better patient care is the goal of clinical governance. I refer to it as the democracy of the health care system, in which all members of the health care team have the right to bring about positive changes.

Accountability and learning from self-criticism forms the basis of clinical governance, which provides the framework for taking all steps necessary to make the system more patient friendly. It is a cyclical process that once established can help to identify the decisive factors for the quality of patient care. When asked by one of my trainees when the mechanisms of clinical governance ensure in everyday practice, my answer was, “In a patient-centred practice it never stops.” It starts as early as the patient first contacts a practice or a hospital and encompasses the entire health care scenario, starting with welcoming and managing a new patient, ensuring his or her safety on our premises and advising him or her about all aspects of treatment. This combination is all about our transparency to the outside world, ensuring that arbiters and our patients can be certain of our quality of care.

More simply put, clinical governance is the umbrella under which we can provide the best care possible for our patients. It is a structural framework that incorporates all pillars of the health care system. There are channels for the health care team, management and patients alike. Particularly for the last, clinical governance provides an environment free from potential hazards. In addition, patients are given a voice in the system through patient feedback, ensuring that if they draw attention to any wrongdoing, lessons are learnt and such mistakes are not repeated.

For our staff and team members, clinical governance ensures that they will be inducted into the system effectively in the beginning and be a part of that system through organisational meetings and their annual appraisals throughout their whole career. This way, they will have the best opportunity to improve their skills and advance their professional development. Moreover, this allows them to better judge their clinical effectiveness and communication skills.

Since training and career development are integral parts of clinical governance, it helps the clinicians to identify their learning needs and plan their continued professional development accordingly. Continuing in this loop, they are able to develop improved awareness about the safety of their work environment, as risk management is one of the basic pillars of clinical governance. Through research and development opportunities, they can also learn new skills and treatment protocols.

Clinical governance is the girdle of an organisation in a health care system: it encompasses all aspects of improved patient care and keeps all involved units in the loop. The management of an organisation can monitor the quality of care provided by it. It can also rate the clinical effectiveness of a particular specialty or clinician. With patient feedback, it can furthermore identify any shortcomings in the system. It will compel the organisation to strive for the professional development of its employees, safeguarding the clinician’s right to develop professionally. The impartiality of the system opens the organisation to scrutiny and maintains the absolute system of checks and balances.

Audit is an indispensable part of clinical governance, as it allows the system to self-analyse and induce changes, thereby debugging it, we make improvements and then re-audit. Once this cycle has been initiated, it will become a continuous process of reanalysis and improvement. The prime feature of this system is that the whole process is self-sustainable once the system has been implemented. The checks and balances in the system will keep it going and evolving.

The process of clinical governance is quite well established in the Western world, but it is time that this essential system of health care delivery become established in developing economies. After all, it is all about the patients: it is to ensure their continued good care that we study intensely and pursue professional development.

Dr Kashif Hafeez is currently in private practice in Carterton in the UK. He can be contacted at hafeezkashif@hotmail.com.
“Bowie’s teeth were like everything else about him: different”

An interview with German tooth artist Jessine Hein

David Bowie was undoubtedly a major figure in popular music in the 1970s and 1980s. He is also one of the many celebrities who have undergone cosmetic dental treatment and had his characteristically crooked teeth replaced with a set of crowns in the early 1990s. Inspired by Bowie’s unique original look, Jessine Hein, a German painter and sculptor, made a reproduction of the singer’s natural teeth. Dental Tribune had the opportunity to speak with Hein about her denture sculpture and her perception of beautiful teeth.

Dental Tribune: Ms Hein, how did you come up with the idea of recreating David Bowie’s teeth?

Jessine Hein: Bowie’s teeth were like everything else about him: different! Not the aesthetic norm, not perfect, but they were strikingly beautiful in the context of his whimsical and miraculous being. His smile revealed an imperfection that made him seem more real, more human, someone to identify with even.

An imperfection worn confidentially inspires sympathy. Bowie was a role model for me. I was very conscious about the loss of the Ziggy Stardust choppers. Teeth are an integral part of interhuman communication. They are inevitably involved in laughing, talking, screaming and of course singing. Bowie sang to us through his crooked gaps and it was enchanting! So the idea for the sculpture evolved while I was nostalgically longing back to Bowie’s old teeth.

Have you done any other artistic projects related to dentistry that inspired you to create a denture sculpture?

In the past, I have done small projects at a dental laboratory, such as a tooth pendant for my necklace, which I have worn ever since and never taken off. And also another sculpture: Tooth Nuckles. With the knowledge acquired during those projects, I gained an idea of how I could actually construct this replica.

In your opinion, what drove David Bowie, who was celebrated as a nerd, to have his crooked teeth made into a “perfect” Hollywood smile?

I find it noteworthy that a pioneer of individualism, the archetype of “acting out oneself”, decided to “normalise” his mouth. It seemed paradoxical. However, the dental change was parallel to a change in his image and music. It accompanied his development and I assume that was not pure accident, owing to the Hollywood set of teeth that was chosen rather than recreating a natural look when medical intervention was needed.

I cannot imagine that a person like David Bowie willingly left the interior design of his mouth to someone else, so I interpret the pearly whites he got as a bold statement that signalled a new chapter in his career—maybe a comment on the beauty obsession of our society: “You want regulated perfection? Here you have it!” The transformation was part of his development from alien hero of the heart to world star. My sculpture intends to underline this, as well as pay homage to the era of the crooked-toothed miracle who fell to earth once upon a time.

Could you believe that Bowie was not satisfied with his teeth and underwent cosmetic dental treatment for that reason? Perhaps, his crooked teeth were a source of suffering, as it is the case with many other people.

I do understand how orthodontics can improve one’s self-confidence, as I went through years of tooth alignment myself in my teens. There are four teeth missing in my maxillae. Besides having had trouble chewing properly, I looked like a freakish vampire. It was not very helpful to have an odd-looking set of teeth in this awkward phase of adolescence. Back then, I did not appreciate the beauty in the difference because I was too concerned with trying desperately to survive as a shy teenager at school.

Today, however, I celebrate teeth that are not the norm. I love the diversity and character they bring to the human head. I find it quite sad that these days almost every child undergoes some kind of dental treatment to align his or her differences solely for aesthetic reasons. Some of them might grow up wishing they still had their characteristic natural look.

I have heard Bowie talk about his old teeth in a confident way. He stated they looked fine to him. So, no, I do not think he felt uncomfortable about them at the time, quite the opposite; he was famous for celebrating his striking body in all its otherworldliness.

What do you intend to do with the sculpture? Have you been approached by collectors and fans of the singer who would like to purchase it?

The sculpture is currently being presented in the context of the new pieces. I have been approached by several potential buyers, but the sculpture is not currently for sale, as I would like to have the option of putting it on display.

Thank you very much for this interview.

The artist herself wearing a tooth mask.

The transformation was part of his development from alien hero of the heart to world star. My sculpture intends to underline this, as well as pay homage to the era of the crooked-toothed miracle who fell to earth once upon a time.

The photo from 2007 showing Bowie with his new smile. (Photo Everett Collection)
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Per-Ingvar Brånemark—An innovative genius

Prof. Tomas Albrektsson, Sweden, remembers the man who changed dentistry with the discovery of osseointegration of dental implants

Per-Ingvar Brånemark passed away on 20 December 2014 at the age of 85. Throughout his career as a researcher, he overcame fierce opposition to dental implants and revolutionised methods for treating edentulous patients.

An extremely gifted scientist, Brånemark was also as witty and quick on his feet as they come. Various language editions of Reader’s Digest hardly contained a medical journal of note, published an article in the late 1960s about his research on microcirculation. At the end of his first lecture about dental implants in Landskrona in Sweden in 1969, a member of the audience, who turned out to be a senior academic of Swedish dentistry, rose and commented, “This may prove to be a popular article, but I simply do not trust people who publish themselves in Reader’s Digest.” As it happened, that senior academic was well known to the Swedish public for having recommended a particular brand of toothpick. Brånemark immediately rose and struck back, saying, “And I don’t trust people who advertise themselves on the back of boxes of toothpicks.”

Young and naive as I was, I thought they were just poking fun at each other, but it turned out to be the opening shot of an eight-year battle with the dental profession. When someone casts aspersions on dental implants several years later because Brånemark was not a practising dentist, he hasn’t been unkindly. “Teaching them anatomy is good enough for me.”

Brånemark completed his medical training at Lund University in 1959 with a doctoral thesis on microcirculation in the filia of rabbits. Grinding the bone to a state of transparency permitted the use of intravital microscopy to analyse the blood flow in both bone and marrow tissues. Thencevia, which found wide recognition both in Sweden and abroad, landed Brånemark an appointment at the Department of Anatomy of the University of Gothenburg just a year later. He was appointed as Associate Professor of Anatomy (later received a full professorship) in 1965, which qualified him for laboratories of his own and the opportunity to surround himself with a team of researchers.

Brånemark continued to pursue his studies in microcirculation in animal models and ultimately in humans. A plastic surgery technique was used to prepare soft-tissue cylinders on the inside of the upper arm. He then inserted optical devices enclosed in titanium that enabled intravital microscopy of microcirculation in male volunteers.

By the late 1960s, he was able to produce the highest resolution images of human circulation in the history of medicine. Many people are familiar with Lemnert/Nilsön’s photographs of circulation that were taken at Brånemark’s laboratories and developed at the Department of Anatomy. Brånemark used a hollow optical device surrounded by titanium to study microcirculation in rabbit bone, permitting both bone and blood vessels to grow through a cleft where they could be examined by means of light microscopy. During such an experiment in 1962, he discovered that the optical device had fused into the bone, a process that he eventually dubbed osseointegration. He revealed his incomparable strength as a researcher at that very moment, realising immediately that the discovery had clinical potential and determining to focus on the development of dental implants, an enterprise that had hitherto been regarded as beyond the scope of medical science.

Brånemark grasped the fundamental truth that edentulousness represents a significant disability, particularly for people who cannot tolerate dentures for some reason. He operated on his first patient in 1965, a mere three years later. The academic community was largely distrustful and hostile to the new approach. The debate was not put to rest until 1977, when three professors at Umeå University in Sweden announced that Brånemark’s technique was the recommended first-line treatment. Opposition in other countries eventually waned as well and dental implants, originally manufactured by a mechanic in the basement of the Department of Anatomy, scored one international triumph after another.

Nowadays, an estimated 15–20 million osseointegrated dental implants are installed every year, and a number of different academies in the field hold annual conferences attended by as many as 5,000 participants each. The University of Gothenburg features a permanent exhibition on osseointegration technology and there is a museum in Brånemark’s honour at the Faculty of Stomatology of Xi’an Jiaotong University in Xi’an in China. The Per-I Brånemark Institute has been also established in Bauru in Brazil.

Not only dentistry

Back in the 1970s, Brånemark began collaborating with ear specialists and technicians at Chalmers University of Technology to explore the additional potential of osseointegrated implants for developing hearing aids inserted behind the ear. Hundreds of thousands of patients around the world have had operations based on the technology initially developed in Gothenburg under his direction. Those of us who were on the team at the time will never forget a teenage girl who suffered from the effects of thalidomide. The medicine had caused not only limb deformities, but also hearing loss in many patients. Equipped with the new hearing device, she learnt to speak flawlessly.

The team also targeted facial deformities occasioned by congenital or acquired injuries. A number of implants installed in the viscerocranium served as fasteners for silicon prostheses, a much more attractive option than attaching them to the patient’s glasses. Since the first operation in 1977, the use of the technology has become widespread internationally.

Titanium implants installed in the femur were the next spin-off of Brånemark’s research. Patients with above-knee amputations cannot have socket prostheses around soft tissue and may have to rely on a wheelchair to get around. Implanting titanium screws in the femoral stumps permitted the installation of a prosthesis and the ability to walk again. I can still remember the first patient as if it were yesterdays. Another teenage girl had been run over by a streetcar in Gothenburg and had above-knee amputations on both legs. She was consigned to spending the rest of her life in a wheelchair. The operation was highly successful and she learnt to walk again.

Acclaimed around the world

Brånemark was fuelled by a passion to help difficult-to-treat patients, and many of his clinical discoveries from the first dental implant on were made in response to cases that had seemed hopeless. His innovative genius, fortified by a large research laboratory at the Department of Anatomy, also skyrocketed Gothenburg-based pharmaceutical companies like Nobelpharma and Astra Tech into leading positions in the global market. He was devoted to the academic community’s social responsibility long before many of his colleagues were aware of, much less accepted, the concept. Ultimately, the world came around and he was awarded honorary doctoral degrees by 29 universities and honorary memberships by more than 50 scientific associations—not to mention the Royal Swedish Academy of Engineering Sciences’s medal for technical innovation, the Swedish Society of Medicine’s Söderberg Prize, the European Inventor Award for Lifetime Achievement and many other distinctions around the world.
“Operating in Asia is completely new to us”

An interview with Neoss Chief Financial Officer Guy Leaver, UK

As one of the few manufacturers of dental implants, UK company Neoss has not operated in Asia before. With a recent financial support package of £1.5 million from Yorkshire Bank, the company intends to develop new business in countries like Japan, China and Taiwan. Dental Tribune Asia Pacific had the opportunity to speak with Chief Financial Officer Guy Leaver about the upcoming market entry and what makes Neoss stand out from its numerous competitors there.

DT Asia Pacific: Mr Leaver, how is this investment package helping you with your market entry into Asia?

The investment package will support our product launch in Asia initially. Currently, we are going through regulatory approval processes in Japan, China and Taiwan. It is difficult to say exactly when, but our expectation is that this year, probably in the second half, we will actually start to make initial sales. While we expect the growth to be significant, we need the facility for money going out before money actually comes in.

What are your initial expectations for the region?

Since we do not have any sales in these countries at the moment, operating in Asia is completely new to us. We obviously have projections and want to see this business grow consistently over time into something substantial.

Initially, we will focus on our dental implant system, as this is the product segment we are expecting approval for this year. In the future, we will expand to our full product range, including new products we are introducing that could also potentially target these markets. It is not an implant but works in conjunction with implants and is going to address the same customer base. We will be launching it at the International Dental Show in Cologne and other shows and congresses around the world in the upcoming months.

Will you sell directly in Asia or through distributors?

We have already signed up with business partners in these markets. In Japan, for example, we have an experienced distributor who has personal contact with a number of leading clinicians in the country who we understand are interested in using our implant system. It always helps to have this kind of endorsement. We are also working with a major distributor in China and will see how that evolves. Potentially, we will put a person in charge of China, but this will depend on how successful we are. If we feel there are more opportunities, we can always tweak the model. There is also an experienced distributor who will be partnering with in Taiwan who has previously distributed a competitor’s product.

Generally, we try to choose people who understand what our product is all about, are familiar with the market and know what works in that marketplace.

For Western manufacturers, the market environment in Asia can be tough. Where do you see the challenges for your company there?

As with many of these markets, business in Asia is primarily relationship based, so you need to become involved with the right people and institutions. This is particularly important in China, where there are a growing number of small private dental practices offering dental care in addition to the large government-run hospitals. We aim to take advant-
Google: How to get on to Page 1 in 2015

Naz Haque
UK

The holy grail for any organisation’s online marketing is to appear on Page 1 of Google search results. Imagine how many patients you would gain. How would you like to achieve this without spending thousands of pounds? This is possible if you have time on your hands and reduce online competition through local listing.

According to Google, there are over 40,000 search queries every second. This roughly amounts to 5.5 billion searches per day globally, with a significant portion of this (increasing all the time) being searches on mobile devices.

Google is always tweaking and improving the search factors to deliver search results based on the user’s intent. Therefore, it is understandable that your website should be focused on patients and easy for Google to find and read. Even without a state-of-the-art website, it is possible to appear on Page 1. Organic (natural non-paid) rankings are achieved by being relevant and having authority in the online world, and depend on online competition.

On Page 1 of Google, aside from the organic listings, there are typically three to seven map listings. The most feasible way of achieving Page 1 rankings in your location is to register for a Google My Business listing first. If it has already created a listing, you will have to claim and verify this. Choose the tags relevant to the services you provide (dental practice) and ensure that your phone number (geographical number) is displayed, as well as your address and post code. Do also brand the page with your logos and personalise it with photographs of your team and practice (not necessary for rankings but highly advised). Finally, encourage your patients to leave you a five-star review on this page. This is a very important factor.

Once you have your page set up and optimised, the next step is to establish your online authority by inserting a link to your Google Business Place on your website. Ensure that your website has your contact details displayed. Then list your address details in local and large directories (try not to get carried away) and ask local businesses to cite your details online. Ensure that the details are always consistent and accurate, as inconsistent address or telephone number details will confuse Google.

Citations are a key factor for ensuring Google recognises your presence in your location. There are no guarantees with Google, but you should always focus on building visibility where Google is looking, because your patients will be directed there.

Citations are a key factor for ensuring Google recognises your presence in your location. The more five-star reviews you have, the higher your score will be. It has been documented that having five stars encourages a 25 per cent increase in click through to your website.

That the time period of your business page has been verified and is visible is also a factor in its visibility.

These simple steps will set you in the right direction to achieving Page 1 rankings. Remember the results will be specific to your location and based on the user’s search terms. Google is focused on the user, so if there are seven other practices nearer to the user’s post code they inevitably will be higher up on the results list. Consider organic or pay-per-click campaigns if you want to have a higher chance of success.

“Citations are a key factor for ensuring Google recognises your presence in your location.”
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For some time, we have been benefiting from IPS e.max® CAD-on/Veneering Solutions (Ivoclar Vivadent), a working technique that combines lithium disilicate (LS2) and zirconium dioxide (ZrO2). In addition to IPS e.max ZirCAD and IPS e.max CAD blocks (Ivoclar Vivadent), the technique includes the use of a high-frequency vibrating device (Ivomix, Ivoclar Vivadent) and a special thixotropic fusion glass-ceramic to join both of the ceramic structures. In this case report, we will demonstrate how to implement the technique step by step in order to achieve natural-looking and functional restorative results.

In our case, the patient visited the dentist because she was unhappy about her maxillary anterior restoration. The ceramic material had flaked off at several sites and the function of the metal–ceramic bridge was impaired. Consequently, she wanted to have it replaced (Fig. 1).

A detailed examination of the clinical situation established that, owing to severe bone atrophy, teeth #11 and #21 were not suitable for anchoring a new dental prosthesis to them and that they would have to be extracted. Since the patient was unwilling to undergo augmentative procedures, placing an implant-retained prosthesis was not an option. Instead, we decided to install a fixed bridge that would be anchored to abutment teeth #14 and #12 on one side and to teeth #24 and #22 on the other side.

The area surrounding teeth #11 and #21 would have to be reconstructed with artificial gingiva.

Treatment procedure

After removal of teeth #11 and #21, the extraction site was allowed to heal for a sufficient period (Fig. 2). Meanwhile, the technician fabricated a diagnostic temporary for evaluation of the aesthetic and functional parameters. In order to achieve a harmonious smile, the incisal edges of the anterior teeth had to be lengthened considerably (Figs. 3a & b). During the try-in, the contour of the artificial gingiva was determined and shaped (Fig. 4). Based on the wax-up, the technician created a temporary that was allowed to heal for a sufficient period (Fig. 2). Meanwhile, the technician fabricated a diagnostic temporary for evaluation of the aesthetic and functional parameters. In order to achieve a harmonious smile, the incisal edges of the anterior teeth had to be lengthened considerably (Figs. 3a & b).

Easy and effective—Long-span bridges fabricated with the CAD-on technique
functional requirements of the patient. The situation achieved with this rather gradual approach was used as a reference in the subsequent fabrication of the final restoration (Fig. 1).

It was then time to select the materials and manufacturing method that would allow the data gathered in the previous processes to be converted into a high-strength aesthetic restoration. We opted for the IPS e.max CAD on technique/IPS e.max CAD Veneering Solutions, as this method allowed for accurate reproduction of the diagnostic wax-up. Dedicated software divides the data into two sets for the production of the ZrO<sub>2</sub> framework and the LS<sub>2</sub> veneering structure. The model and the wax-up were both digitalised and imported into the program (Figs. 6a & b).

The primary structure (framework) was created using ZrO<sub>2</sub> according to the CAD/CAM technique. Its accuracy of fit was checked on the model and then the framework was sent to the laboratory for try-in (Figs. 7–9). The framework showed an excellent fit and did not require any reworking (Fig. 10).

Based on the data, the veneers were milled from IPS e.max CAD. This secondary structure was easy to adapt to the framework (Fig. 11). Still in their intermediate (pre-crystalline) state, the LS<sub>2</sub> veneers were adjusted to match the pre-existing morphological characteristics. A base for veneering the gingival parts was also created. Contouring the artificial gingiva with composite material by a dentist would happen at a later stage.

We were now ready for the final stage. After checking the functional and morphological parameters, we joined the ZrO<sub>2</sub> framework and LS<sub>2</sub> veneer with the IPS e.max CAD Crystall./Connect fusion glass-ceramic (Fig. 12a & b). Crystallisation or fusion firing was conducted in a Programat furnace using a dedicated firing program. Afterwards, the restoration was customised to match the specific characteristics of the patient’s dentition and subjected to a characterisation/glaze firing process (Figs. 13 & 14).

Completing the restoration

After the try-in, the restoration was returned to the laboratory to add some final touches. A few characterisations were applied according to the given requirements. Those areas of the framework to be veneered with composite were etched to prepare them for the application of the composite material. In the practice, the gingival parts were reproduced using gingiva-coloured composite material in small quantities in several steps. Finally, the all-ceramic bridge was seated using conventional procedures. The result was a restoration that blended in so well that it could hardly be distinguished from the surrounding natural denture (Figs. 16 & 17).

Chipping of the veneering ceramic on ZrO<sub>2</sub> frameworks can often be traced back to a failure to observe the material-specific technical requirements. By using the CAD-on technique described in this report, the risk of failure can be minimised for these kinds of restorations, because the strength of the veneering ceramic used with this technique is four to five times higher than that of conventional veneering ceramics.

The high strength of the ceramic has been confirmed in a study that compared bridges manufactured using the CAD-on technique with ZrO<sub>2</sub> bridges veneered using an individual layering technique. The results of the study showed that the strength of the CAD-on bridges was twice as high (2,188 ± 505 N) as the strength of conventionally veneered bridges.

In this case, accurate diagnostic measurements taken at the presurgical stage, in-depth knowledge of the materials involved in the treatment process, and excellent collaboration led to a highly aesthetic result without the need for surgical intervention. The procedure ideally combines two outstanding materials and has proven to be both reliable and cost-effective.

Acknowledgement: This case was conducted in collaboration with dental technician Paolo Viganò and Dr Leonardo Ruchon from Florence. I would like to thank them both for their support.
Cone Beam Computed Tomography: Is dentistry ready for a new standard of care?

Dr Lee M. Whitesides
USA

Since its commercial introduction into dentistry in 2001, cone beam computed tomography (CBCT) has been rapidly evolving into a new standard of care in maxillofacial imaging. In just over a decade, CBCT has exploded onto the dental landscape and permitted dental professionals a degree of three-dimensional (3-D) anatomic truth in maxillofacial imaging previously unavailable and unattainable.

Like many other new technologies, which have progressed from the extraordinary to the ordinary and thus gained acceptance by professionals and patients, CBCT has advanced from exceptional use to almost commonplace use in dentistry as cost decreases, access to the technology increases, and potential adverse patient interaction (i.e. radiation exposure) is attenuated. Today, CBCT is seen by many in dentistry as the standard operating procedure for many dental implants, orthognathic, orthodontic, or endodontic cases.

The advancement of CBCT in dentistry has caught the attention of manufacturers of radiographic equipment. In 2001, only one company sold a CBCT system. In 2014 there are at least 20 companies selling CBCT machines and technology. Henry Schein, a leading distributor of dental equipment, has seen CBCT sales expand from 5 per cent of their digital imaging sales to almost 90 per cent of digital imaging sales in the last five years.

CBCT has also been recognised by general dentists and specialists as a means by which they can better plan and distinguish their practices as being on the vanguard of technology in patient care. Today’s patients expect their dentist and physicians to be contemporary with technology and services. CBCT provides the doctor with a technology, which not only has significant advantages in treating patients but also has a noteworthy “wow” factor as the 3-D images are seen on a large screen in “real time” for the doctor and patient to view.

CBCT, like plain film radiographic studies, may be considered a revenue generator for a practice. The more a CBCT machine is utilised, the more revenue it will generate. Additionally, the owner may allow others in the profession to utilise the machine for a fee, thereby reducing his overall cost of operation.

Standard of care is a legal not a medical or dental concept. Standards are continuously evolving as methods and techniques in patient care improve. An appropriate definition for standard of care may include such language as: the dentist is under duty to use that degree of skill and care which is expected of a reasonably competent and prudent dentist under the same or similar circumstances. Standards of care may be local, regional or national.

Standard of care influences

The influence of an emerging technology, like CBCT, into a new standard of care involves many criteria. These criteria include:

- maintains that scientific evidence presented to the court must be interpreted by the court as “generally accepted” and expert testimony must be based on scientific methods that are sufficiently established and accepted.

In Frey, the court opined: “Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the technology and CBCT has been tested and proven over many years of application in the medical and dental arena. The Hounsfield unit is the widely recognised standard quantitative scale for describing radiodensity and provides doctors with a known standard and error rate in computed tomography. The widespread acceptance of CBCT by the medical and dental community is demonstrated by the ever increasing presence in dental and medical practices of the technology. Additionally, The Internasional Accreditation Commission, an accreditation organisation for medical and dental imaging, has developed guidelines and accreditation criteria for 3-D CBCT imaging. Thus CBCT appears to have satisfied all the Frey and Daubert criteria for acceptance as a standard of care technology.

In many jurisdictions and in Federal court, the Frey standard is superseded by the Daubert standard. The Daubert standard is used by a trial judge to make a preliminary assessment of whether an expert’s scientific testimony is based on recognised scientific principles and methodology or merely is a theory or technique in question which has not been subjected to peer review and publication, the existence of maintenance standards controlling its operation, widespread acceptance within a relevant scientific community.

The theory or technique behind medical grade computed tomography and CBCT has been tested and proven over many years of application in the medical and dental arena. The Hounsfield unit is the widely recognised standard quantitative scale for describing radiodensity and provides doctors with a known standard and error rate in computed tomography. The widespread acceptance of CBCT by the medical and dental community is demonstrated by the ever increasing presence in dental and medical practices of the technology. Additionally, The Internasional Accreditation Commission, an accreditation organisation for medical and dental imaging, has developed guidelines and accreditation criteria for 3-D CBCT imaging. Thus CBCT appears to have satisfied all the Frey and Daubert criteria for acceptance as a standard of care technology.

Not to discount the value of CBCT imaging or its ability to successfully satisfy the Frey or Daubert criteria, the absence of CBCT is not de facto evidence of lack of a standard of care imaging. Many patients present to their dentist with uncomplicated cases where traditional two-dimensional radiographic studies are appropriate and provide the dentist with standard of care imaging of the patient. For the more complicated cases, 3-D imaging may be employed to provide the dentist with superior anatomic evidence in treatment planning and diagnosis. Three-dimensional imaging with CBCT can also be used in uncomplicated cases, but it may not necessarily be considered the standard of care for every case in 2014.

Expert Testimony

An expert is a person with sufficient minimal qualifications to render an opinion on the subject at hand. Not all experts are created equal, and in fact in three states (Iowa, South Dakota, and New Hampshire) an expert need only be qualified to be able to offer an opinion. Experts are used by the courts to educate the judge and jury as to what constitutes normal minimal acceptable care of a patient in a given environment.

Expert testimony is by definition the opinion of one practitioner. It is an opinion based on fact, evidence, experience, and knowledge which the expert believes to be relevant, valid, and upheld in the scientific community.

When reviewing a case for suspected malpractice the expert examines many things, including but not limited to chart notes, radiographic studies, depositions, and professional correspondence. In the last five years, the author has noticed a remarkable increase in the number of cases in which plaintiffs and defence attorneys, as well as experts, rely on pre- and post-operative CBCT imaging studies to assist in proving malpractice or defending good practice. Post-treatment radiographic imaging to prove malpractice or support good practice is not new to dentistry. In fact in the years preceding WWII, one of the highest malpractice claims were awarded in cases where post-treatment radiographs played a pivotal role.

Logic would dictate that if plaintiffs and defence counsel and experts are making CBCT part of their strategy, then CBCT must be not only prevalent and pertinent but of significant value in the formation of an opinion by an expert. Perhaps this is why when reviewing a case, CBCT can be seen as an additional and important piece of evidence to help explain why the doctor did what he did or why an unfortunate outcome occurred. Additionally, CBCT provides powerful and easily understandable images for layperson jury.

Recognising the value that CBCT adds to a case does not necessarily indicate that CBCT is the standard of care in every case. The decision to obtain a CBCT study before the procedure is determined by the dentist based on his experience and knowledge of the case.

Literature Support

For any technology to be considered as a standard of care, a plethora of literature in support for the technology should exist. The literature must discuss the risk and benefits of the technology, provide evidence in treatment planning and diagnosis. Three-dimensional imaging with CBCT can also be used in uncomplicated cases, but it may not necessarily be considered the standard of care for every case in 2014.
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To assess the influence of CBCT in the dental literature, the author performed a PubMed literature search in October for the words cone beam CT, cone beam CT + dental implants, cone beam CT + orthodontics, cone beam CT + oral surgery, cone beam CT + endodontics, cone beam CT + endodontics in the search line. The results are in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Key words in search</th>
<th>Number of articles</th>
<th>Year article first appeared</th>
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<tbody>
<tr>
<td>CBCT</td>
<td>5,537</td>
<td>1988</td>
</tr>
<tr>
<td>CBCT + endodontics</td>
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<td>2007</td>
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<td>2003</td>
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<tr>
<td>CBCT + endodontics</td>
<td>515</td>
<td>2007</td>
</tr>
</tbody>
</table>


But of these exhaustive articles demonstrate the plethora of literature addressing CBCT and its application in the many disciplines pertaining in the literature of articles pertaining to the use of CBCT in the various disciplines in dentistry. The vast majority of literature discovered pertains to addressing the use of CBCT in treatment planning and diagnosis of patients in dental implant therapy, oral and maxillofacial surgery, orthodontics, and endodontics. Articles on new applications of CBCT technology to patient care were also prevalent in the sample. Some articles addressed the risk and benefits of CBCT but none denounced CBCT as harmful to the patient or insignificant in treatment planning and diagnosis. Two similar PubMed reviews of the literature on CBCT were performed by authors Alamri et al (Applications of CBCT in dental practice: A review of the literature, Gen Dent 2012: 60(5): 390–400) and De Vos et al (Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: Systematic review of the literature. Int J Oral Maxillofac Surg 2009;38: 609–625).

Professional Guidelines:
For a technology such as CBCT to become a standard of care in dentistry, guidelines for its use and application in patient care must be established by the organisational bodies of those disciplines who may employ the technology to treat patients. In dentistry, the dental practitioners most involved in the use and application of CBCT in patient care include general dentists, oral and maxillofacial surgeons, endodontists, oral and maxillofacial radiologists, orthodontists, and periodontists.

The American Dental Association has over 180,000 licensed dentists representing approximately 75 per cent of dentists in the USA. The American Dental Association published an advisory statement article in its principal journal, The Journal of the American Dental Association, in August 2012. The article discusses the many positive aspects of CBCT, but stops short of calling CBCT a new standard of care. Rather, the ADA encourages the dentist to use CBCT “selectively, as an adjunct to conventional radiography”. The ADA further recognises the value and presence of CBCT by including CBCT-related courses at its annual meetings and continuation education courses during the year.

The American Association of Oral and Maxillofacial Surgery (AAOMS) has over 9,000 members representing approximately 95 per cent of oral and maxillofacial surgeons practising in the US. Literature addressing the application of CBCT in oral and maxillofacial surgery has been around since 2007. The AAOMS has offered continuing education in the use and application of CBCT for patient care as far back as 2011. The AAOMS has worked with the IAC to develop guidelines and accreditation criteria for 3-D CBCT imaging. In a recent survey of OMFS residency programmes, 87 per cent of programme directors acknowledged the use of CBCT in patient care by their residents.

The American Association of Endodontists (AAE) and the American Association of Oral and Maxillofacial Radiologists (AAOMR) have released a formal position paper on CBCT. This paper makes important points, such as limiting the field of vision to minimise radiation exposure and increase resolution, careful patient selection in CBCT, and the responsibility of the clinician to interpret the entire image. The position paper goes on to declare “the use of CBCT in endodontics should be limited to the assessment and treatment of complex conditions”. The article then lists nine of these “complex conditions”. In summation, the position paper recognises the value of CBCT as...
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This article showed the following: CBCT in patient care. US periodontal programmes use CBCT in the field of endodontics. "CBCT may provide dose savings and be considered as an imaging tool, an adjunct to 2-D images and facilitate the incorporation of CBCT technology to dentistry. The vast majority of post-doctoral residents involved in dental implant patient care and all private dentists feel that their training in the US incorporate CBCT in their dental implant education curriculum. Many professional organisations in dentistry for general dentists and specialists have weighed in on the need to provide recommendations, guidelines, CE programmes, and position papers are used by professionals to influence the practice of their discipline. As the practice of dentistry changes in response to many factors including, but not limited to, advances in technology, professional organisations (i.e. pay for) a new service such as CBCT, revenue from patients, insurance companies, or government-sponsored health care is minimal. Revenue can be directly from the owner/operator to have the necessary training. There are many questions yet to be answered definitively which is subject to the laws of other parties. As CBCT becomes widely available, the technology appears to be more expensive to own and operate the machine, as well as, and interpret CBCT images? There are many questions yet to be answered definitively which is subject to the laws of other parties. As CBCT becomes widely available, the technology appears to be more expensive to own and operate the machine, as well as, and interpret CBCT images? There are many questions yet to be answered definitively which is subject to the laws of other parties. As CBCT becomes widely available, the technology appears to be more expensive to own and operate the machine, as well as, and interpret CBCT images?
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A professor in the Division of Advanced Prosthodontics at the University of California, Los Angeles School of Dentistry in the US, Dr Takahiro Ogawa is one of the main advocates worldwide for photo-energy-mediated activation of implant materials, a process also known as photo-functionalisation. Dental Tribune Asia Pacific recently had the opportunity to talk with him about the benefits and prospects of this innovation.

Dental Tribune Asia Pacific: Photo-functionalisation is achieved by exposing titanium surfaces to ultraviolet light. Would you describe this in more detail and the mechanical or chemical processes that take place during the process?

Dr Takahiro Ogawa: Photo-functionalisation is a 12-minute conditioning of dental implants in the device immediately prior to implant placement. The reason for this process is that titanium ages with time, and this particularly affects its ability to integrate with bone.

The photo-energy activation device boasts an optimised combination of ultraviolet lights that effectively remove hydrocarbon from the implant surface, transforming the surface from hydrophobic (water-repelling) to hydrophilic (water-friendly). This change in properties, together with the clean titanium surface, attracts more osteogenic cells. Photo-functionalised titanium surfaces are electrostatically positive and further enhance cell attraction because cells are electro-negative.

All this is intended to make osseointegration of dental implants much better and faster. The ageing process of implants degrades hydrophilicity. Can the features of an aged implant surface be fully restored by photo-functionalisation, and does the technology have any limits?

Not at all. A series of studies have indicated that photo-functionalisation is effective on any implant surface type whether acid-etched, dual acid-etched, oxidised, sand-blasted, nano-featured or machined surfaces.

While photo-functionalisation can restore implant properties to a degree similar to when it was manufactured, the revitalised implant surfaces degrade time-dependently in the same way as those of regular implants. Therefore, dental implants undergoing treatment with the device need to be placed immediately.

Has the technique been tested in in vivo studies and, if so, what results have you found so far?

According to a number of preclinical studies, the strength of osseointegration can be increased three times by photo-functionalisation at the early healing stage. Photo-functionalisation makes implant and abutment surfaces bacteria phobic.

The bone-implant contact of photofunctionalised implants reached 98.2 per cent, compared with 50–55 per cent achieved with the control implants. Moreover, it has been found that photo-functionalisation increases the quality of marginal bone formation, as well as improves the outcome of guided bone regeneration, when applied to titanium mesh. Studies indicate that there are not only short-term benefits of photo-functionalisation. Reliability and predictability in function and aesthetics are expected to increase with time, providing clinicians with a new strategy for a better long-term prognosis for dental implants and reducing the risk of peri-implantitis.

You say that photo-functionalisation could become a standard procedure for dental implant therapy. When will that happen, in your opinion?

Dentists in Japan have been using photo-functionalisation for approximately three years. In Europe, premarketing of the photo-functionalisation device has recently started. I believe that other regions will catch up shortly and make this technology a global standard in implant dentistry. A number of projects are also underway utilising photo-functionalisation in the field of general bone engineering and orthopaedic implants and reconstruction.

Thank you very much for the interview.
Forensic odontology—Broader than just identification

Dr Richard Bassed
Australia

Nowadays, most people will associate forensic dentistry primarily with identification and bite mark analysis. These areas do indeed form the majority of an odontologist’s workload. There are, however, other aspects of the discipline that are just as important but perhaps less well known. These include cranio-facial trauma analysis, age estimation for both living and deceased individuals, dental manifestations of child abuse, dental malpractice investigations, as well as dental insurance fraud.

Forensic odontology is an integral part of the medico-legal process. With this comes a responsibility borne by forensic odontology practitioners for the requisite education, qualifications, and ongoing training. Courts and legal institutions now require that we have evidence-based research upon which we can rest our findings and conclusions. In addition to knowledge of the law, we have to have knowledge of human anatomy and its relationship to injury patterns and interpretation. Knowledge of bite mark patterns due to assault, trauma and sexual abuse, as well as child abuse injury manifestations, is also required, as is knowledge of assessment techniques used when the age of an individual is unknown. Finally, there is a need to have knowledge of human identification methods, principles and practices, as well as mass disaster identification procedures and protocols, and the ethical issues involved in the examination and management of dead bodies, and to have an understanding of human rights issues involved in war crimes investigations.

All of these require thorough knowledge of cranio-facial anatomy, dental anatomy, dental and skeletal development, injury interpretation and medico-legal report writing. It is also important to have a good understanding of the law relating to the practice of dentistry, the coronial system, and the criminal justice system. As the majority of the forensic odontology caseload concerns the identification of unknown deceased individuals, most discussion in this article will concentrate on this.

Honouring the dead is a fundamental precept in all societies. The extent of this communal attention to the deceased varies across the world, but in essence everyone hopes that his or her remains will be treated with respect after death. This respect for the dead includes, for many societies, robust identification of the deceased so that relatives and friends are able to treat the remains with appropriate ceremony and are able to visit the resting place of the deceased whenever they wish. So important is the perception of personal identification in almost all societies that authorities will go to extraordinary lengths to ensure that deceased individuals are not interred in unmarked graves, or cremated without a name.

To be buried anonymously goes against all of our religious, cultural and ethical belief systems, and implies that a life unremembered and unremembered was really a life without consequence. William Gladstone, Prime Minister of Britain in the mid-1800s, encapsulated this sentiment better than most when he said, “Show me the manner in which a nation cares for its dead and I will measure with mathematical exactness the tender mercies of its people, their loyalty to high ideals, and their regard for the laws of the land.”

Hal Hallenstein, the Victorian State Coroner from 1886 to 1914, also had firm views concerning the importance of human identification, articulated in the following quotation: “It is a hallmark of our civilisation that we regard it as an affront, an indignity, an abrogation of our responsibilities, that a person could live amongst us, die and be buried without a name.” In fact, the importance of identification of the deceased is enshrined in the Victorian Coroners Act 2008 (section 67), which states: “A coroner investigating a death must find, if possible, the identity of the deceased, the cause of death, and the circumstances in which the death occurred.”

Positive identification of the deceased not only satisfies a commitment to probity, but also resolves many legal issues surrounding an individual’s death, such as inheritance and life insurance. If a deceased person remains unidentified, then technically he or she will not be declared dead for a number of years, thus creating further distress to families who not only are unable to put their lost loved one to rest, but may suffer financially as well.

Personal identification of the deceased, and occasionally the living, is achieved through a variety of scientific and sometimes unscientific methods. Practitioners from forensic science, forensic medicine, law enforcement and coroners’ offices apply their own particular set of skills to an identification problem in order to arrive at an answer. The most common method used to identify the deceased in all jurisdictions is undoubtedly visual recognition by a relative or close friend. There is continual debate concerning the veracity of this method, given the propensity for error, which has been well documented, especially in mass casualty events and in situations in which the deceased has suffered trauma to the face. From the forensic medical/scientific perspective, visual recognition is not proof of identity, but is only presumptive.

Theory of human identification
Methods used to achieve positive human identification can be separated into two broad categories. The first consists of those methods that are presumptive for identification, such as circumstantial evidence, property associated with the body, and visual recognition. These methods involve a high degree of subjectivity and rely on identifiers that are not intrinsic to the body itself, are dependent on lay interpretation, and therefore can be falsified or mistaken (commonly known as secondary identifiers).

The second category relies on scientific analysis of identifiers that are intrinsic to the body, such as dental restorations, fingerprints, DNA, and verifiable medical records (primary identifiers). These involve characteristics that can be objectively appraised and compared to ante-mortem exemplars in both a quantitative and a qualitative way and that are difficult or impossible to falsify.

Of all the scientific methods, molecular biology is the only method that can mathematically quantify the degree of certainty for a particular match, with the other methods (including odontology) being somewhat dependent on more subjective methodological and expert opinion. This reliance on even a small level of subjective certainty can raise issues in courts when lay people do not have a deep understanding of the methods employed in an expert’s conclusion.

Confusion can arise from the fact that there is often no unanimous indication regarding which and how many characteristics are necessary in order to achieve a positive identification. The recurrence of discordant features excludes identity; the occurrence of several concordant features commonly observed within the population does not allow a final judgment on identification, whereas even a few features rarely observed can lead to a positive match.

An example of this is a case in which the written dental chart describes amalgam restorations in each first molar.

If the same is found in the deceased, is this sufficient evidence to confirm identity? Definitely not, as many people share this restoration pattern. If, however, we also have antemortem radiographs of those restorations displaying the exact shape, size and location within each tooth, and these compare favourably with the post-mortem radiographs, then few would argue that a positive match cannot be confirmed. There is, however, still no way to quantify this match, to put a probability ratio or a percentage certainty to it.

It may be necessary in some cases to compare all of the teeth in a mouth in order to arrive at a match. In other cases, a single tooth with an unusual or complex restoration may be sufficient. It has long been the wish of identification experts to be able to quantify such matches, but no reliable method has yet
been devised and so a degree of expert subjectivity is still required.

Prior to the availability of scientific methods applicable to the issue of positive human identification, the only real option for relatives and friends to recover the mortal remains of their loved ones was to visually examine them and to form a decision regarding whether the person before them was indeed who they believed him or her to be. On the face of it, positive human identification by visual recognition would seem to be a fairly simple matter, even as long as the deceased had undamaged facial features. We can all recognise people who are well known to us by their facial features and movements, even in poor light and at odd angles. This has been shown to be true in many studies concerning the recognition of living people via CCTV security footage. Why then are there documented cases of misidentification and error, throughout the ages?

The process of visual recognition is complex and until quite recently not well understood. Clues as to the identity of an individual, either living or deceased, rely upon both the physical structure of the face, but also with the variety of facial expressions, the effects of artificial make-up, and context and in which the individual is seen.

DNA profiles are encrypted sets of numbers that reflect a person’s DNA makeup, which can also be used as the person’s identifier. Although 99.9 per cent of human DNA sequences are the same in every person, enough of the DNA is different to distinguish one individual from another, unless they are monozygotic twins. DNA profiling uses repetitive sequences that are highly variable, called variable number tandem repeats (VNTRs), particularly short tandem repeats. VNTR loci are very similar in closely related human populations, which is why VNTR fingerprint identification involves using an expert, or an expert computer program, to compare VNTR prints retrieved from an object with latent prints already on file with authorised (and with their consent) suspects. Reproduction of the exact angulation and aspect of an antemortem radiograph in a post-mortem radiograph, taken in less than ideal circumstances, system operating under threshold scoring rules, determining whether two friction ridge impressions are likely to have originated from the same finger or palm (or toe or sole). The validity of forensic fingerprint evidence has been challenged by academic, judges and the media. While fingerprint identification was an improvement on earlier anthropometric systems, the subjective nature of matching (especially when incomplete latent prints are used), despite a very low error rate, has introduced an element of controversy.

A deceased person has lost all facial expression, animation, and context and simply looks different from when he or she was alive. Inquest into death, decomposition and context changes may also be present and go unrecognised. Couple this with the stress and trauma being experienced by the identifier, who may well have never seen a dead body before, and it is easy to see how someone may make a mistake. This is compounded by the way visual identifications are often performed, in that the deceased is presented to the identifier in order to confirm what the authorities may well for all practical purposes have determined is the cause of death. This is compounded by the way recent changes in the context of forensic fingerprint evidence, dental radiographs, fingerprint identification involves using an expert, or an expert computer program, to compare VNTR prints retrieved from an object with latent prints already on file with authorised (and with their consent) suspects. Reproduction of the exact angulation and aspect of an antemortem radiograph in a post-mortem radiograph, taken in less than ideal circumstances, system operating under threshold scoring rules, determining whether two friction ridge impressions are likely to have originated from the same finger or palm (or toe or sole). The validity of forensic fingerprint evidence has been challenged by academic, judges and the media. While fingerprint identification was an improvement on earlier anthropometric systems, the subjective nature of matching (especially when incomplete latent prints are used), despite a very low error rate, has introduced an element of controversy.

Medical record comparison can be used for identification purposes when there is sufficient ante-mortem evidence of unique medical intervention or disease. Examples include the discovery of medico-legal teeth such as pacemakers and prosthetic hips, which will have engraved on them serial numbers, which can also be challenging. In order to reach conclusions to these difficult identification puzzles, the forensic dentist not only needs a solid grounding in all of the techniques available, but also requires a level of experience and, in the early years, a degree of mentoring.

Dental identification is not only achieved using comparison of restorations; other features of the teeth and maxillofacial skeleton may also be employed. Root morphology, sinus configuration, unusual crown shape, and pulp chamber morphology are all factors that can be considered in the absence of restorations, as long as there are high-quality ante-mortem images with which to make a comparison. Study models, sport mouth guards, partial dentures, orthodontic appliances and photographs of the dentition are all useful aids for a forensic odontologist and are employed with varying degrees of reliability, depending on the circumstances of the case.
able in its development. It has been recognised recently, however, that published standards for tooth development may not be as accurate as assumed, owing to the fact that they were constructed many decades ago and in other parts of the world, and therefore may bear little resemblance to modern populations. Considerable work is currently underway to address this issue, with new population datasets being established around the world.

Odontologists are also researching the ability to estimate more accurately the age of older individuals, around the adult/child demarcation age of 18 years. This is being achieved through the use of multifactorial approaches, where the third molar and various other skeletal development sites are assessed together in order to arrive at an estimate (Fig. 1a–c). This is seen as an important research in light of the increasing need to determine the legal status of individuals such as asylum seekers, accused human traffickers who may be children and risk being incarcerated in an adult prison, child soldiers, and victims of sexual assault in developing countries, all of whom are unlikely to possess proof of age documentation.

It has been shown that more than half of all cases of child abuse involve cranio-facial injuries, perhaps owing in part to the significance of the face and mouth in communication and nutrition. Forensic odontologists are rarely involved in these difficult cases, but despite this play an important role in injury description and providing help with determination of causation. All of the principles involved in cranio-facial trauma analysis for adults are applicable here, but with emphasis on the developing anatomy and different biomechanical characteristics of the child facial skeleton.

Dental malpractice and insurance fraud investigations are increasing, partly owing to greater public awareness of what constitutes a dentist’s duty of care and responsibility to patients, and partly owing to our increasingly litigious society. For this aspect of practice, the odontologist requires thorough knowledge of the various pieces of legislation relating to dental practice, the professional codes of conduct, and the latest information on treatment modalities, as well as good medical record-keeping skills.

Conclusion

Forensic odontology is capable of providing rapid and relatively cost-effective identification of the deceased, as long as reasonable ante-mortem dental records are available. In countries such as Australia, the laws concerning medical record-keeping ensure that dental records are, in the main, of good quality and easily retrieved in the event they are required.

In other countries, this may not be the case, and identification of the deceased in some parts of the world represents a serious and ongoing issue for governments and humanitarian organisations. Good record-keeping is not only of benefit to forensic practitioners, but also relevant to the work of odontologists includes educating health authorities in less developed parts of the world to encourage good record-keeping. The benefit of good record-keeping can be seen in recent mass fatality incidents, such as the Victorian Black Saturday bushfires, where, despite the availability of a well-resourced DNA capability, more than half of all victims were identified by dental record comparison.

The scope of forensic odontology is broader than identification alone and encompasses a range of activities, anything in fact where the practice and theory of dentistry intersect the law. To be a competent practitioner in this discipline requires not only a comprehensive understanding of odontology theory and technique, but also a degree of knowledge and experience in a variety of forensic fields, including law, pathology, clinical forensic medicine, molecular biology and anthropology. The forensic odontologist encounters all of these disciplines in different case scenarios, and in order to understand how the odontologist can contribute best to an investigation he or she needs to comprehend the capabilities and limitations of these fields.
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