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.

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 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.

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 developing 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.

Dentist best job in the United States

US News & World Report has announced that dentist and dental hygienist are again among the best jobs in the United States, with dentists at No. 1. Dentist is also among the 2015 top paying jobs in the country, only preceded by physicians, who top the list with an average of US$189,440 earned in 2013.
Dr. Malek Verma, President of the Indian Dental Association.

If implemented effectively, the new declaration, formulated in Dakha, Bangladesh, last November, would make Asia the largest and most densely populated continent to phase out the controversial material, said Dilip Pattanaik, Executive Director of the Orissa State Volunteers and Social Workers Association, a local non-profit organisation, and one of the initiators of the initiative.

“Amalgam is a primitive, polluting product whose high metal content leads to cracked teeth. It is so old that it pre-dates the birth of Mahatma Gandhi. It has no role in 21st-century dentistry and it is generally rejected among younger and more modern dentists,” he commented.

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 methylmercury, 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 Dentistry 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 1.6 tons.

Journalist, doctor and colleague: A tribute to Elsa Cayat

Dr. Marc Revise
Scientific Editor, Dental Tribune France

Elsa Cayat was killed along with 11 of her colleagues, in the attack against French newspaper Charlie Hebdo in Paris on 7 January 2015. She leaves behind a 22-year-old daughter.

Elsa worked as a psychiatrist and psychoanalyst. She had her internship at the age of 22. “Charlie Divan” was the name of the column she wrote for Charlie Hebdo. She also published two books, Un homme + une femme = quoi ? [A Man + A Woman = What?] and Le Désir et la putain [Desire and the Whore]. In a twist of irony, we had been working together on an essay about death, transmission and love over the past year. Parental authority and the lasting damage it can cause was also one of her favourite themes.

Although a free spirit, Elsa was always attentive. Her very special laugh was distinctive. Her enthusiasm and lust for life could be felt when she would say, “Soooo, what’s new with you?”

Open to many things, she loved to flick through the Dental Tribune that I would sometimes leave on her desk. On 5 June 2014, we celebrated the release of Patrick Pelloux’s book On ne vit qu’une fois! [You only live once!] with Charlie Hebdo editor Stéphane Charbonnier and the rest of the Charlie Hebdo team.
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 and in several languages. The wide range of topics includes general dentistry, digital dentistry, practice management, as well as specialties, such as implantology and endodontology. The webinars are presented by experienced speakers and participants are awarded continuing education credits.
Opinion

Je suis Charlie

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, whatever happens, people will always choose humanity and rea-

spective procedures with amalgam.

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 in dentistry, 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 natura-mimetic dentistry for the long-term health and beauty of teeth and smiles.

Yours sincerely,

Daniel Zimmermann
Group Editor
Dental Tribune International

No place in clinical dentistry

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 forming tooth restorations with amalgam 15 years ago, not because of its toxicity, but because it is not a natura-mimetic 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 no harm dentistry his or her practice philosophy and adopts minimally invasive restorative techniques to achieve natura-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.

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A man of humour and humanity

When I met Prof. Per-Ingvar Brånemark in his workshop 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 osseo-integration 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 Osseo-integration, 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 forever.

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 dsushilloirala@gmail.com.

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

Dr Kashif Hafeez
UK

While accountability and improvement have been eminent 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 the 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 ensue 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 arithers 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 throughout 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, filtered, that is, 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.

20th March 2015
World Oral Health Day
Smile for life!
“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 characteristic 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 confidently inspires sympathy. Bowie was a role model for many people and I think his teeth contributed to that. The vast variety of talents, iconic style and incomparable philosophy that make up Bowie, and the different universes he created around himself, have always impressed and inspired me. I have been incredibly fascinated with teeth for a long time and have paid close attention to the ivory of those I admire. Therefore, I was very conscious about the loss of the Ziggy Stardust choppers.

Teeth are an integral part of interpersonal 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, as well as 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 maxilla.

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 on display. The artist herself is holding a tooth mask.

The sculpture is a pioneer of individualism, the “acting out oneself”. It is a testament to the singer’s all-encompassing artistic projects. It is a symbol of Bowie’sCharlie Watts. My sculpture intends to underline this. 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.

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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 osseointegration. 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 start of an unequal battle with the dental profession. When someone cast aspersions on dental implants several years later because Brånemark was not a practising dentist, I was not in any way surprised. “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 fibula of rabbits. Grinding the bone to a state of transparency permitted the use of intravital microscopy to analyse the blood flow to both bone and marrow tissue. Thrombosis, which found wide recognition both in Sweden and abroad, launched Brånemark on 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 encased in titanium that enabled intravital microcirculation to study in rabbits, 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 presents 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 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 P I Brånemark Institute has been also established in Baunro 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. Inserting 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 in both legs. She was consigned to spending the rest of her life in a wheelchair. The operation was very 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 hitherto been regarded as hopeless. His innovative genius, fortified by a large research laboratory at the Department of Anatomy, also skyrocketed Gothenburg-based pharmaceutical companies likeNicel Bache 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 this development by choosing the right contacts for this marketplace.

Guy Leaver

Where do you want to position yourself in the market?

We want to position ourselves in the same way as we do in most markets by delivering a product that is the best there is. We strongly believe that we have a good package. Our company was founded by a clinician and an engineer, so our focus is on delivering exceptional clinical performance and product quality. There is no point in introducing a product that is not as good as someone else’s. Our product has to be that good or even better.

We always want customers to understand that they are getting a value product. We do not sell cheap or offer massive discounts. It is a good quality product at good pricing. In terms of customer service, we aim for exceptional logistics and support. Take Europe, for example, it is pretty much next-day delivery, so if you buy something from us in Germany, it will probably be there at noon the following day. Few of our international competitors can achieve the same.

Thank you very much for the interview.

Operating in Asia is completely new to us

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Thank you very much for the interview.
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. 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.

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Citations are a key factor for ensuring Google recognises your presence in your location. They have no guarantees with Google, but you should always focus on building visibility where Google is looking, because your patients will be directed there. The recipe for success in any business is focus on serving the client, and it seems the same rule applies with your online marketing. Focus on the patient in using the platform is key to everything.
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Massimiliano Pisa
Italy

For some time, we have been benefitting 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.

Fig. 1: The patient required a new prosthetic restoration. Teeth #11 and #21 could not be saved and had to be removed.

Fig. 2: Situation after teeth #11 and #21 had been extracted and the site allowed to heal.

Figs. 3a & b: The aesthetic and functional parameters were evaluated in the patient’s mouth with the help of a temporary.

Fig. 4: The gingival contour was shaped in the oral cavity.

Fig. 5: The temporary in its planned, ideal situation.

Figs. 6a & b: The temporary and master model were digitalised (CAD software).

Fig. 7: The ZrO2 framework was prepared for milling (CAM software).

Fig. 8: The ZrO2 framework being milled.

Fig. 9: As the primary structure, the sintered ZrO2 framework provided the base for the digital production of the veneering structure.

Fig. 10: The ZrO2 framework on the model.

Fig. 11: Situation after milling of the veneering structure (LS2).

Figs. 12a & b: Joining the framework and veneering structure (IPS e.max CAD Crystall./Connect).

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).

The primary structure was 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.

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.
parameters, we joined the ZrO₂ functional and morphological final stage. After checking the data into two sets for the process to be converted into a conventional veneering ceramics.

The primary structure (framework) was created using ZrO₂ according to the CAD/CAM technique. Its accuracy of fit was checked on the model and then the framework was sent to the practice for try-in. The framework showed an excellent fit and did not require any reworking.

Based on the data, the veneers were milled from IPS e.max CAD. This secondary structure was easy to adapt to the framework (Fig. 13). Still in their intermediate (pre-crystalline) state, the LS 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 ZrO₂ framework and LS veneer with the IPS e.max CAD Crystall./Connect fusion glass-ceramic and an Inovox mixing device (Figs. 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 with the temporary as a guide (Fig. 13). A natural-looking gingiva shield was achieved by applying the material in small quantities in several steps. Finally, the all-ceramic bridge was seated using conventional procedures. The result was a restoration that hardly be distinguished from the surrounding natural dentition (Figs. 16 & 17).

The high strength of the ceramic has been confirmed in a study that compared bridges manufactured using the CAD-on technique with ZrO₂ 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 vs. 2.05 N) as the strength of conventionally veneered bridges.

In this case, accurate diagnostic measurements taken at the preservative 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 Vigiani and Dr. Leonardo Rachorlin from Florence. I would like to thank them both for their support.

Reference

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Congress Chairman
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Cone Beam Computed Tomography: Is dentistry ready for a new standard of care?

De 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 procedures, orthodontic, orthodontic, or endodontic cases.

The advance 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 50 per cent of their 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 separate, identify, and distinguish their practices as being on the vanguard of technology in patient care. Today’s patients expect the dentist with a technology, which is scientifically valid and can separate, identify, and distinguish his overall cost of operation.

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. Standard of care is evolving as methods and techniques in patient care improve. An appropriate definition for but are not limited to: court verdicts, expert testimony, literature support, professional guidelines, cost and availability of the technology, reimbursement by third party payers, and multi-specialty use and recognition.

Taken individually, these criteria do not mandate a standard of care for any technology as a standard of care. Nor are these the only criteria one may use in determining standard of care. Taken together, these criteria provide strong evidence that CBCT technology has sufficiently evolved to be considered the standard of care in maxillofacial imaging in selected cases to assist the dentist in treatment for patients in need of dental implants, orthodontic surgery, manipulation of difficult impacted teeth, orthodontics, endodontics, and many other facets of dentistry.

The legal perspective

The legal system in the United States is complex and fragmented. No database exists to search verdicts in dental malpractice cases in which CBCT has played an important or pivotal role. For a new technology to become admissible as a standard of care in court, it must pass the Frye test. This standard comes from Fry v. United States which is a 1923 in a case discussing the admissibility of a polygraph test as evidence. The Frye standard of the principle must be recognised, and while the courts will go a long way in admitting experimental testimony deduced from a well-recognised scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.

In many jurisdictions and in Federal court, the Frye 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 based on reasoning or methodology that is scientifically valid and can properly be applied to the facts at issue. Under this standard, the factors that may be considered in determining whether the methodology is valid are:

• theory or technique in question can be and has been tested,
• it has been subjected to peer review and publication,
• there is a known or potential error rate,
• 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 in dental and medical practices states (Iowa, South Dakota, and New Hampshire) an expert need only be qualified 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 correlations. 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 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 (and the jury) 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. This literature would support the risk and benefits of the technology, support good practice, and support the dentist and patient care, and guidelines and protocols for acceptable use.
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Evaluation of Table 1 data clearly shows a significant presence 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): 760-4) 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).

Table 1

<table>
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<tr>
<th>Key words in search</th>
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<td>2007</td>
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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, cone beam CT + dental implants, cone beam CT + orthodontics, cone beam CT + oral surgery, cone beam CT + endodontics, and cone beam CT in the search line. The results are in Table 1.

Professional Guidelines

For a technology such as CBCT to become a standard of care in dentistry, guidelines for its use and application in the patient care must be established by the organisations bodies of those disciplines that independently 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 continuing education programmes. 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 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 USA. 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 3D 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 several 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 summarisation, the position paper recognises the value of CBCT as...
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Oral Implantologists (ICOI), the influence of CBCT in the field of dentistry

The American Association of Endodontists sponsored continuing education in endodontics related to CBCT on their website and the organisation devotes valuable time at its annual meeting. Most residency programs (44 of 47) in endodontics provide CBCT for patient care.

Lecture pertaining to CBCT in dentistry dates back to 1998. The amount of refer- ence in the literature is considerable, considering the importance of CBCT in dental implant treatment planning. CBCT is a valuable diagnostic and therapeutic tool that allows for accurate placement of dental implants. Its ability to visualize the maxillary sinus, nasopharynx, and other structures surrounding the teeth makes it an essential tool for dentists who perform implant surgery.

Many professional organisations in dentistry have recognised the benefits of CBCT in clinical practice. The American Academy of Periodontology, the Academy of General Dentistry, and the American Academy of Restorative Dentistry have all endorsed the use of CBCT in their guidelines and recommendations. The American Dental Association (ADA) has included CBCT in its guidelines for dental implant treatment planning.

The Dental Educators Network (DENet) has surveyed dental educators in the US, and in 2009, 73 per cent of dental implantology programmes use CBCT. This shows the increasing acceptance of CBCT in dental implantology education. The ADA also provides online courses in CBCT for dental implantologists.

Although many professional organisations have endorsed the use of CBCT, there is still some debate regarding the cost and availability of this technology. The high cost of CBCT machines and the need for continued education and training are some of the factors that limit its use.

In conclusion, CBCT has become an indispensable tool in dental implantology. Its ability to accurately visualise the surrounding structures of the teeth has revolutionised the way dental implants are placed. However, its widespread adoption is hindered by its high cost and the need for ongoing education and training.

18 Trends & Applications

DENTAL TRIBUNE Asia Pacific Edition No. 1+2/2015

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“Photo-functionalisation is effective on any implant surface type”
An interview with Dr Takahiro Ogawa, 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 tested 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 Bassett
Australia

Nowadays, most people would 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 medical-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 in almost 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.

Honouring the dead is a fundamental precept in all societies. The protection of human remains, as a symbol of our humanity, is a fundamental precept in all societies. The protection of human remains, as a symbol of our humanity, is a precept to which we as 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 1896 to 1994, 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 Coroner’s 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 in 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 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 unsound methods. Practitioners from forensic science, forensic medicine, law enforcement and coroner’s 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, but 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 methodology and expert opinion. This reliance on even a small level of subjectivity 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 characterizations are necessary in order to achieve a positive identification. The recurrence of discordant features excludes identity; the occurrence of several corroborating 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 ante-mortem 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 required.

Prior to the availability of scientific methods applicable to the issue of positive human identifi-
cation, the only real option for relatives and friends to recover the mortal remains of their loved ones was to visually examine the body and attempt, with some degree of certainty, to confirm what the authorities would for all practical purposes take for granted. Visual identifications are often unreliable and are fraught with difficulty, as the nature of the evidence being assessed is frequently one of similarity rather than absolute identity. Often antemortem dental identifications have been challenged or discredited, even in poor light and at odd angles. This has been shown to be true in many studies concerned with the recognition of living people via CCTV security footage. Why then are there documented cases of misidentification through visual recognition of the deceased, even of intact and undamaged faces?

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, rest not only with the physical structure of the face, but also with the variety of facial expressions, the unique physiological characteristics, and the context in which the individual is seen.

DNA profiles are encrypted sets of numbers that reflect a person's DNA make-up, 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 identification using fingerprint prints (friction ridges) relies on an examination of antemortem prints already on file with authorised individuals, or more commonly with latent prints retrieved from an object the subject of the examination was known to have touched. Finger printing identification involves an expert, or an expert computer system, operating under threshold scoring rules, determining whether two friction ridge im-
pressions 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 academ-
ics, judges and the media. While fingerprint identification was an improvement on earlier anthrop-
ometric systems, the subjective nature of matching (especially when incomplete latent prints are used), despite a very low error rate, has introduced an ele-
ment of controversy.

Identification methods can be unreliable, as only the third molecular marker, VNTRs, are used in DNA analysis, but although with less certainty. Identification using DNA evidence relies on the comparison of an ante-mortem sample (reference sample) with a post-mortem sample, and may include direct comparison of the decrement’s DNA (e.g. Guthrie cards or an ante-mortem blood sample), or a comparison with relatives’ DNA (parents, children or siblings), to arrive at a conclusion. The conclu-
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tion, usually because of trauma, incineration, decomposition, or multiple deaths resulting from a single incident, then forensic practitioners are able to rely on more scientific means to determine identity. The common methods employed include molecular biology, medical records, finger printing, fingerprints, and dental record comparison.

In situations where the deceased was known to have touched. Finger printing identification involves an expert, or an expert computer system, operating under threshold scoring rules, determining whether two friction ridge im-
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able in its development. It has been recognized 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-e). This is seen as 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 medico-legal report writing 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 organizations. 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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