Economic downturn affects adoption of CAD/CAM in Asia-Pacific region

A number of studies have shown a link between tooth loss and mortality. Now, an analysis of almost 600 elderly participants from Japan has provided new evidence that retaining good oral health and having more teeth at an older age could be an indicator of longevity. The study showed that the risk of mortality was associated with the number of remaining teeth.

In order to assess the possible role of the number of teeth as a predictor of mortality in the elderly, researchers at the Niigata University examined the oral cavities of 569 healthy 70-year-olds.

During a follow-up period of five years, 25 (4.4 per cent) participants died. The researchers observed that individuals with 20 teeth or more had a significantly lower mortality rate (2.5 per cent) compared with those with 19 teeth or fewer (6.1 per cent). Overall, the data indicated that there was a 4 per cent point increase in the five-year survival rate per additional tooth retained at the age of 70, the researchers reported.

A study from the UK has found that people who chewed gum after hearing catchy songs thought less often about the song than in two control conditions in which they did not chew gum or tapped with each of the fingers of their dominant hand, respectively. Chewing gum also reduced the frequency with which they “heard” the song by one-third.

Market player reorganises

Kavo Kerr Group has announced that it will be reorganising three of its five professional consumables brands. After the internal restructuring, Kerr, Kerr TotalCare and Axis|SybronEndo will be operated under four core identities: Kerr Restoratives, Kerr Endodontics, Kerr Rotary and Kerr TotalCare.

Gum helps with earworms

A study from the UK has found that people who chewed gum after hearing catchy songs thought less often about the song than in two control conditions in which they did not chew gum or tapped with each of the fingers of their dominant hand, respectively. Chewing gum also reduced the frequency with which they “heard” the song by one-third.

Eat your curry

New research has demonstrated that curcumin, one of the primary components of turmeric and curry powders, has a quelling effect on the activity of the human papillomavirus (HPV), which has been increasingly associated with the development of oral cancer over the past several decades.

The scientists found that the natural antioxidant curcumin slows the expression of HPV, suggesting that it could help control the extent of HPV-related oral cancers.

Oral squamous cell carcinoma is the sixth most common cancer worldwide. The World Health Organization states that the incidence of oral cancer ranges from one to ten cases per 100,000 people in most countries.

More teeth, longer life

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In one of the worst earthquakes in over 80 years, more than 10,000 people are believed to have died in the Federal Democratic Republic of Nepal. Living in and practising dentistry in the capital of Kathmandu, dentist Dr Sushil Koirala has been directly affected by the disaster.

Dental Tribune Asia Pacific had the opportunity to talk to him briefly about the situation in the country and how the international community can help to overcome the humanitarian crisis.

“Have you heard from colleagues in other parts of the country, and if so what is their situation?”

Most of my dental colleagues are unharmed, but many of them are facing problems with their damaged clinics. Most of the dental hospitals in Kathmandu are still closed owing to the damage and employees not being able to work because they are busy rebuilding their lives. Various agencies have estimated that more than eight million people across 59 of the country’s 75 districts have been affected by the earthquake. The most

Dr Sushil Koirala: The earthquake on 25 April had a devastating effect on our country’s infrastructure and its people. What is the situation currently in Kathmandu, and how have you been affected personally?

Mom looking at destruction caused by the 25 April earthquake in the Nepalese capital Kathmandu. Damages are estimated at US$920 million. (Photo: Niravindra Shrestha/RFA)

In the first episode of the earthquake. Some of my staff from the hospitals and clinics lost their houses unfortunately and have to stay with relatives for the moment.

“We are still pretty much in shock.”

An interview with Nepalese dentist Dr Sushil Koirala

In second position, the University of Hong Kong is located in the midst of the Swedish leaders.

The list of top ten dentistry schools further includes the University of Michigan in the US at number four, KU Leuven in Belgium in fifth place, Tokyo Medical and Dental University in Japan ranked sixth, King’s College London in the UK at number seven and the University of Otago in New Zealand at number eight.

The QS World University Rankings by Subject 2015, 85,982 academics and 41,910 graduates from 60 countries and 894 universities were asked to list up to ten domestic and international institutions they consider excellent in categories such as academic reputation, citations per faculty and employer reputation. In one of the worst earthquakes in over 80 years, more than 10,000 people are believed to have died in the Federal Democratic Republic of Nepal. Living in and practising dentistry in the capital of Kathmandu, dentist Dr Sushil Koirala has been directly affected by the disaster.

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severely affected areas include the Bhaktapur, Dhading, Dolakha, Kathmandu, Katra, Lalitpur, Nuwakot, Ramechhap, Rasuwa, and Sindhupalchowk districts of Nepal’s Central Region, as well as the Gorkha District of its Western Region.

Have you received any correspondence from the dental community?

I am glad to have received many e-mails with best wishes and prayers from our dental friends around the world. It is so gratifying to know that many of them have pledged their support of the earthquake victims of Nepal. Some dental manufacturers have shown keen interest to help us in the rehabilitation of children who have been affected.

Despite an immediate response from India and Western countries, relief efforts seem to be insufficient, according to reports. What is your impression?

International communities have offered immediate support and we really appreciate their help. However, 39 of the most affected villages are in remote locations with mountainous terrain. The relief work, therefore, is hampered and support items cannot be delivered on time. Many people in these small villages are still waiting for basic items, such as food and shelter.

Regardless of the efforts by the Nepalese army, police and Red Cross Society, as well as national and international organisations, which are working 24/7, the manpower and supplies are still felt to be inadequate.

In your opinion, how will this disaster affect the infrastructure of your country in the long run?

Nepal’s development budget depends mainly on foreign aid. Rebuilding all the infrastructure affected by the earthquake will require an estimated US$200 billion. The government plans to meet this mainly through foreign and international funding. However, damaged infrastructure will definitely affect the economic growth of Nepal negatively.

When I will be able to start practising again depends on when all my staff are mentally ready for work. Daily life in Kathmandu is still very stressful, as there are frequent aftershocks and people are still terrified. Under these conditions, I do not expect people will come for general dental treatment, except in the case of an emergency.

What do you consider the most important to improve your situation, and how can the international dental community help?

More than 95 per cent of houses and infrastructure have been damaged in the affected villages, so the rehabilitation phase for the earthquake victims is going to be a great challenge for our country. I personally feel that in order to overcome this difficult time our country needs support from each individual and professional in Nepal. We have, therefore, started a humanitarian project, the Dental Community for Humanity—Nepal Earthquake Relief Project, under the umbrella of the Punyaarjan Foundation, a charitable and non-profit organisation dedicated to supporting people most in need. This project aims to support poor children living in these remote villages in particular. I humbly appeal to the international dental community to support this cause. Please, with your donations and support, we can bring back the smiles of our poor children.

Thank you very much for taking the time and all the best for the future.

Dr Sushil Koirala

For more information on how to support the Dental Community for Humanity project, please contact Dr Koirala at drsushilkoirala@gmail.com.
Owning a dental practice or group has always presented challenges, but the marketplace has never been more crowded than it is now. With an ever-increasing level of choice for patients, it is more important than ever for dental businesses to stand out from the crowd. While we of course all know the value of providing a first-rate customer service, and that will always remain the most important factor, how many of us recognise the importance of creating and building a brand?

Generally, in dentistry, branding has not been regarded in the same way it is in the corporate world, where multi-national businesses expand on the strength of their brands. But now, with the growth of dental corporates and multi-practice groups, branding is becoming an increasingly important factor. That is not to say that branding is only the domain of the big players. Creating a brand which is unique and people can identify, talk about, recommend to others and remember is just as important for a single practice, and in some situations even more so, where there are other local competitors for existing and potential clients to choose from.

Effective branding is also important when looking to expand, franchise or sell one’s business. When dentists are adding another site to their existing portfolio, doing so under a brand will enable people to know who is moving into their area, and can help give confidence that this is an established dental business taking over their local site. One example being a business in North East England I act for, the Burgess & Hyder Dental Group, who now operate 11 clinics across the region under their brand. They are welcomed into each area because their brand is widely known, as is the quality associated with it.

Equally in franchising, the importance of a strong brand is crucial to enable a business to thrive in other areas. Each site under that umbrella will offer the same levels of service and quality. Another of my clients, Damira Dental, has recently rebranded from Aspire Dental Care, and is pursuing a franchising model under its new and fresh identity. The business, which has 14 sites across the South of England, has amassed a strong reputation during its eight years in operation, and the strength of its service coupled with its branding will allow that to be replicated across the UK.

The creation of a brand identity, which can help support the expansion of a business, can also be of great importance when it comes to selling. It is much easier to market a business which is well known and has invested time and effort in standing out from the crowd. To a potential buyer, they are important factors in instilling the confidence to take on a site in a new territory.

In this day and age of dentistry being an increasingly competitive business, distinguishing oneself from the many other players has never been more important, and is something that must be given due consideration.

Amanda Maskery is one of the UK’s leading dental lawyers. She is Chair of the Association of Specialist Providers to Dentists (ASPD) in the UK and a Partner at Sintons law firm in Newcastle. She can be contacted at amanda.maskery@sintons.co.uk.
WASHINGTON, USA: US health authorities have updated their guidelines for fluoride in drinking water and now recommend an optimal fluoride concentration of 0.7 mg/l. As Americans today have greater access to fluoride in the form of toothpaste and mouthrinse and owing to the increasing incidence of fluorosis due to excess fluoride, the Department of Health and Human Services sought to replace its previous recommendations that were issued in 1962.

Since the early 1960s, the practice of adding fluoride to public drinking water systems has grown steadily in the US. Nearly all water fluoridation systems in the US have used fluoride concentrations ranging from 0.8 to 1.2 mg/l. With the recent update, however, this will be reduced by 0.1 to 0.5 mg/l, and fluoride intake from drinking water alone will decline by approximately 25 per cent. The total fluoride intake will be reduced by about 14 per cent.

According to the department’s report issued on 27 April, the new optimal concentration of 0.7 mg/l was chosen to maintain caries prevention benefits, but reduce the risk of dental fluorosis.

Although a number of studies have found that community water fluoridation has led to a significant decline in the prevalence and severity of tooth decay, data from the 1999–2004 National Health and Nutrition Examination Survey and the 1986–1987 National Survey of Oral Health in US School Children indicate that over 20 per cent of people aged 6–49 have some form of dental fluorosis.

Today, nearly 75 per cent of Americans who are served by public water systems receive fluoridated water. In 2012, the Centers for Disease Control and Prevention estimated that approximately 200 million people in the US were served by 12,341 community water systems that added fluoride to water or purchased water with added fluoride from other systems.

Artificial fluoridation of drinking water remains controversial as a public health measure, as it has been suggested that excess fluoride may have adverse health effects. For instance, it has been associated with neurodevelopmental delays in children and with the development of attention deficit hyperactivity disorder only recently.

In contrast to fluoridation policy in the US, many western European countries, including Austria, Belgium, Finland, Germany, and Sweden, do not fluoridate their water supply. Other European countries, such as Ireland and the UK, currently add fluoride to drinking water at levels ranging from 0.2 to 1.2 mg/l.
Swiss study finds sonic toothbrushes vary greatly in efficacy

BERN, Switzerland: Sonic toothbrushes are increasingly used in daily dental care today, as they promise to reduce biofilm without any mechanical bristle contact owing to hydrodynamic effects. However, not every model is equally effective in cleaning teeth, a recent study by researchers at the University of Basel has found.

In order to inhibit damage to the gingiva and teeth, the biofilm formed by oral bacteria must be removed regularly. Sonic toothbrushes claim to reduce the amount of biofilm—even in areas that are difficult to reach, such as the lateral tooth area and interdental spaces—without any mechanical bristle contact.

This is possible because of the high frequency movements of sonic toothbrushes, which are believed to cause hydrodynamic effects that remove adhesive bacteria. These effects result from acoustic sound waves, as well as the shearing forces and the surface tension forces of moving air bubbles in liquid media.

However, the Swiss researchers found that the effectiveness of different models of sonic toothbrushes varies greatly. The toothbrushes analysed in their study reduced the amount of biofilm by between 9–80 per cent.

In their in vitro study, the researchers cultivated an artificial biofilm on titanium plates. The biofilm contained three different strains of bacteria and was developed by dousing the titanium plates in a mixture of saliva and serum. Afterwards, the researchers tested the impact of four commercially available sonic toothbrushes on the artificial biofilm. They varied the distance between the toothbrush bristles and the biofilm surface (0.2 and 4.0 mm), as well as the exposure time (2.4 and 6.0 seconds). Using fluorescence microscopy and special software, the researchers then quantified the remaining biofilm.

They found distinct variations regarding the efficiency of the sonic toothbrushes. The two high-quality products analysed were able to reduce the amount of biofilm on the titanium plates significantly, whereas two low-cost models had only little impact on the artificial biofilm. According to the researchers, the different exposure times and bristle distances did not influence the reduction of biofilm.

The study, which was co-financed by the research fund of the Swiss Dental Association, confirms the results of various international studies and proofs that sonic toothbrushes can reduce biofilm without actual bristle contact—although the cleaning efficacy depends greatly on the respective toothbrush model used.

The research fund of the Swiss Dental Association is financed through the membership fees of the association’s member dentists. It supports and fosters dental research, especially in the fields of prevention and dental practice.

The study, titled “Efficacy of various side-to-side toothbrushes for noncontact biofilm removal”, was published in the Clinical Oral Investigations journal in April 2014 and was recently reported in the 2/2015 issue of Dimensions, the journal of the Swiss Dental Hygienists.
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“Holding ConsEuro in London was a little bit of a risk”

An interview with Prof. Stephen Dunne, King’s College London Dental Institute

As one of many dental organisations to do so, the European Federation of Conservative Dentistry (EFCD) chose to hold its international congress in the UK this year. Dental Tribune Asia Pacific sat down with EFCD President and King’s College London professor Stephen Dunne in London to discuss the event and how technology is increasingly shaping the field of dentistry.

Dental Tribune Asia Pacific: Prof. Dunne, the ConsEuro conference in London seems to have been excellently organised. Would you say that the event has met your expectations?

Prof. Stephen Dunne: To be honest, holding ConsEuro in London was a little bit of a risk because with all the other conferences to be going on this year in the capital and other parts of Britain there could be an overload. We actually spent months discussing a window in which we would attract the highest number of delegates.

With 500 and growing so far, the congress has clearly exceeded our expectations and, while previous congresses in Italy or Turkey might have had a bigger turnout, the conference here has attracted delegates from 29 countries, including from Australia, the US and the Middle East. It is probably one of the most multinational conferences we have ever had.

You were originally planning for 350–450 participants. Can the outcome mainly be attributed to the London factor?

Yes, we chose one of the best conference centres in the world with the Queen Elizabeth II Centre right in the heart of London, it is fair to say that we also chose one of the most expensive ones. This made us very concerned when we planning this three years ago because at that time we were in an economic downturn. Trying to re-cover the costs. We actually sold out between the EFCD and King’s College London.

King’s recently made it to the list of the top ten best dental schools globally. How much do you think the school’s reputation contributed to the congress outcome?

There are a number of dental schools surveys and rankings worldwide. Despite different methodologies and different variables, King’s usually comes out very near the top, which I am very pleased about. The school attracts not only good teachers and researchers, but also equally good clinicians from across the world.

Owing to the economic situation gradually improving over time, we exceeded our expectations with regard to sponsorships. We actually sold out the exhibition space several months ago. That has been very successful and helped us to cover the costs. We came ahead—break-even on the first day, so I am much more relaxed today than I was yesterday morning. And it looks as though we might make a reasonable profit, which would then be shared.

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Almost every dental practice across the world now employs some form of technology, be it electronic patient records, stock-taking or equipment, such as lasers, CAD/CAM and digital imaging to show patients areas of the tooth they could not possibly see otherwise. Digital imaging and photography are also very important from a medical and legal point of view, as this area is increasingly becoming a concern.

Where do you see the trends with regard to dental materials?

The materials that we use are not available to me when I was in training and in my early practice and the stages or requirements for their use are infinitely more sophisticated. Nowadays, you might have ten stages to a bonding procedure and every one of those stages is critical. If you fail in only one of them, your restoration fails before it has even started.

Historically, dentists have been trained by representatives of the companies who make the materials and that means they may not get the most honest or scientifically valid perspective. Although we very much support manufacturers contributing to education programmes, we certainly like clinicians and scientists to be involved in those to provide the evidence base.

What other lessons will you take home from the conference?

Our conference proves that you can take a high-tech approach and still hopefully be profitable or at least break even. Technology is definitely here to stay; we just need to look at the evidence base. We also need to have training in the use of technology and need to look at clinicians and scientists to guide us in the selection of the particular devices that we should use.

Thank you very much for the interview.
Google Mobile Armageddon and what it means

Naz Haque
UK

Google has just released an update that will prioritise mobile-friendly websites. It is indeed widely known that online audiences are moving to smartphone and tablet computers. At Dental Focus, we have seen massive shifts in the online audience over the last few years to the point now where most clients see a minimum of 55 per cent of their organic audience visits from mobile devices. Websites and marketing campaigns achieve higher conversions when they are mobile optimised. The diagram below shows a marketing campaign we are running at the moment. In this project, we invested heavily in Google pay per click and 95 per cent of conversions were via mobile.

To qualify this trend further, consider that desktop sales have started to decline significantly since 2005. After 2013, the growth in purchases of mobile devices (mobiles, tablets and phablets) has continued to outgrow desktop sales. Google focuses on its users and anyone who wants to have a presence on Google is directed to follow its guidelines to serve these users. In this instance, such users are dentists’ existing and prospective patients. Therefore, it is really important that your website deliver to their online expectations or Google will not present your website to them.

For your website to be mobile friendly, there are specific factors to which it must adhere. The website must not make use of any mobile-incompatible animations created with software like Adobe Flash. This appears as a black space in a mobile screen and serves no purpose. The text on your website should be readable on mobile devices without the user needing to resize or zoom. Responsive websites will automatically adjust to serve readability factors.

User experience has always been a core area from Google’s perspective, and mobile-friendly websites have links separated sufficiently to allow a user to make a selection with ease. Google provides a platform to check whether websites are mobile friendly. Just type in your website address at www.google.com/webmasters/tools/mobile-friendly.

There is no reason to panic if your website is not ready yet; however, expect to lose more customers to businesses with mobile-friendly websites, as they will be favoured by Google. The company has such a massive job to do reading the entire Internet, it is unlikely you will start suffering from 12.01 a.m., but you can expect to see your rankings diminish over time, especially on a mobile device search.

Your presence on Google is directly affected by your competition, so if your practice is in the middle of nowhere with limited competition you will live another day, but surely it is time that you start to think how to best serve your audience before it is too late.

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The importance of pretreatment dental assessments in cancer treatment

Prof. Ansgar Cheng
Singapore

In Singapore, an average of 33 people are diagnosed with cancer daily and one in three die from some form of the disease eventually. While treatment for oral cancer, including tongue cancer, is associated with difficulty swallowing, pain and psychological trauma to the patient, it essentially becomes more common.

The importance of pretreatment dental assessment and treatment cannot be overemphasised. Many dental problems are silent and they may not cause any clinical symptoms when a person is healthy. When chemotherapy or radiotherapy is indicated for cancer patients, it is important that the dentist who is dealing with the oral cavity be part of the patient’s core treatment team. A comprehensive treatment team should consist of a radiation and medical oncologist, a cancer surgeon, a dental surgeon trained in the clinical care of cancer patients, as well as a maxillofacial prosthodontist.

The importance of obtaining a pretreatment dental assessment and treatment cannot be overemphasised. Many dental problems are silent and they may not cause any clinical symptoms when a person is healthy. When chemotherapy or radiotherapy is indicated for cancer patients, it is important for them to seek a pretreatment dental assessment to identify and address any underlying dental issues (e.g., gingival problems or impacted teeth) that need to be treated prior to commencing cancer treatment. This is because once radiation treatment has started, oral and periodontal surgery may be contra-indicated. The immune system will be significantly compromised once the patient starts the chemotherapy treatment.

Irradiation also places the patient at high risk of treatment-related complications, such as xerostomia (dry mouth syndrome), oral infections, oral muscle fibrosis, and osteoradionecrosis. Currently, the use of intravenous bisphosphonate-based chemotherapeutic agents is becoming more common. Bisphosphonate is effective in chemotherapy and it essentially slows down bone remodelling. As a result, the bone healing capacity is compromised. A simple dental extraction after the use of bisphosphonate medication may result in bone necrosis that lasts for months, a condition that is complicated and difficult to treat.

The oral cavity contains a myriad of bacteria at any given time, even if a person is perfectly healthy. Many of the normal oral flora cause no symptoms, however, bacteria and fungi in the mouth may develop into an infection when the immune system is not working well or when white blood cell counts are low.

Irradiated tissues can thin and waste away, causing sores in the mouth (ulcerative oral mucositis) in the atrophic mucosa. Such complications can result in a significant reduction in the patient’s quality of life and even death. It is alarming to state that up to 54% of the causative organisms in cancer patients’ deaths are from the oral cavity. Therefore, it is imperative for cancer patients to have a thorough dental check-up, a good cleaning by the dental and problematic areas treated prior to cancer treatment. The bacteria in the mouth are likely to enter the bloodstream, thus increasing the risk of infection for those with compromised immunity due to cancer treatment.

In the healthy mouth, saliva balances the pH value of the mouth. Since irradiated salivary glands produce very little or no saliva, acids in the mouth can take advantage and attack the teeth post-treatment. This greatly increases the risk of dental caries, which in healthy subjects may take years to reach the pulp. When xerostomic, patients commonly develop multiple dental caries that may reach the dental pulp in just a few months.

Undergoing a dental assessment before, during and after cancer treatment is a step that can help save much costs, pain and psychological trauma for the patient. It is also helpful to medical specialists, as they will be able to manage their cancer patients more smoothly.

Pretreatment dental assessment

It would be ideal to allow for a week of recovery from any required surgical dental procedures. Typically, the dentist will go over the patient’s medical history and review the radiographs of the patient. He or she will also conduct a physical examination of the dentition and hard and soft tissue in the patient’s jaw and mouth for abnormal swelling, lesion or evidence of chronic or acute...
dental infection. The dentist should discuss with the patient’s core treatment team all the treatment options and timelines in conjunction with the schedule of upcoming major surgery or cancer treatment. It is essential to be familiar with various radiation, chemotherapy and surgical treatment protocols. Crucial pretreatment assessment will be performed in such a way as to minimise downtime and to keep as close to the originally scheduled medical treatment as far as possible. The initial pretreatment assessment consultation should take under one hour. If there are no pre-existing dental conditions that need to be addressed before the major surgery or cancer treatment, the follow-up may be performed after medical treatment has been completed. In the event that dental treatment is required before the major surgery or cancer treatment, this should be done in a timely manner and with the patient’s best interests and comfort in mind.

The pretreatment dental procedures should ideally be performed by a dental team with experience in the management of cancer patients. For instance, routine dental procedures such as extractions should be approached carefully in the case of cancer patients, mainly because the bone quality of cancer patients may be altered by previous chemotherapy or radiation, as these treatments may significantly slow down or stunt the growth of new bone cells. The dentist should identify teeth with a guarded or poor prognosis and have those teeth removed atraumatically prior to the initiation of cancer treatment owing to the slower healing process in wound sites after extraction. In some cases, the bone around the infection area may turn necrotic (also known as osteoradionecrosis).

Patients should be able to resume usual activities after dental treatment without any major interruption to their daily routine.

Post-treatment oral care
After the cancer episode is over, a patient’s general health condition may be still weaker than that of a healthy person. Therefore, it is important for the patient and any attending dentist to have comprehensive dental records about the patient’s medical history before new dental procedures are considered. For example, the effects of intravenous bisphosphonate treatment and radiation therapy commonly last for years, and the risk of postoperative bone necrosis should never be overlooked.

Continuous post-treatment oral care is critical in the prevention or reduction of the incidence and severity of oral complications. Even though side-effects of cancer treatment may not be life-threatening, they can greatly affect the patient’s quality of life. Hence, it is crucial to help patients manage and obtain relief from side-effects such as mucositis, xerostomia, dental caries, osteoradionecrosis and trismus. Since the immune system is suppressed, any type of infection could be serious. Diligent lifelong personal oral health care and frequent dental recall appointments are recommended.

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Where periodontology has advanced
A critique of current trends in the field

Prof. Mark Bartold
Australia

Over the past 20 years there have been some exceptional advances made in periodontology. Many of these have led to changes in our thinking and our approach to periodontal therapy. In 1999, the American Academy of Periodontology (AAP) devised a “new” classification system for the periodontal diseases. From this some 50 different types of periodontal conditions were identified which were considered worthy of individual classification. Clearly this was an unwieldy system and in reality it was dissected down to three main types of plaque-associated periodontal diseases: gingivitis, chronic periodontitis and aggressive periodontitis.

While the appropriateness of the terms “chronic” and “aggressive” have been debated they have served as a framework for both clinicians and researchers to define specific types of periodontitis with identifiable clinical parameters. It also provided a framework for understanding management protocols and outcomes. Nonetheless, over time it has become evident that such a classification system (chronic and aggressive) may be too simplistic because of the heterogeneity of the periodontal diseases. Therefore, it may be timely to revisit such a classification system and determine whether current understanding of the epidemiology and pathology of these diseases can be used to better define them.

However, it is worth noting that in the past 25 years there have been at least 10 different classification systems proposed, none of which have been fully adopted. Clearly there remain a number of important challenges in this field. Since chronic and aggressive periodontitis are het-

erogeneous groups of diseases, for example, there will be unique subcategories based on their multifactorial nature basis of microbial, host response and thinking of how the subgingival microbiota interacted not only with itself but also the host. Notwithstanding this, research through the 1990’s and 2000’s be-
gan to question the role of the biofilm and its component bacterial consortia in the overall process of development of periodontitis. While it was very clear that periodontitis cannot, in the absence of bacteria, it was becom-
ing increasingly obvious that clinically there were some pa-
tients who, despite the presence of considerable plaque deposits, had become very compelling. Indeed the relevance of oral health to overall health and general well-being was recognised by the US Surgeon General in a land-
mark publication titled “Oral Health in America”. This docu-
ment for the very first time articulated the importance of oral health in an holistic approach to medical care. Despite the title, its contents focused on the whole global scene. From this the concept of periodontal med-
icine gained further traction and its central hypothesis stated that periodontal infection and inflammation presents a significant chronic inflammatory burden at the systemic level. While there is considerable work still to be done significant progress has been achieved in the past decade. Diabetes is now well recognised to be a significant modifying or risk factor for development of periodontitis and conversely periodontal disease is considered to be a significant modifying or risk factor for glycemic control in diabetes. Other conditions for which there is good evidence to support interrelationships with periodontitis include cardiovascular disease, rheumatoid arthritis, obesity and renal disease.

It remains to be established whether treatment of periodontitis has any impact on systemic conditions...

More recently we have seen the development of biological agents and preparations which, when applied onto root surfaces, can result in significant regeneration of damaged periodontal tissues. The use of such agents offers a simpler approach to peri-
dontal regeneration with equivalent, and sometimes superior, results compared to GTR procedures. However, as has been noted for GTR, the clinical outcome when using biological agents can be variable and further work is needed to improve their clinical utility. Moreover, the use of mesenchymal stem cells and gene-

nic modulation of periodontal cells have been explored for the purposes of achieving periodontal regeneration. The future looks promising but no doubt there is a considerable amount of work to be done before reliable and predictable periodontal regeneration becomes a reality.

“Life remains to be established whether treatment of periodontitis has any impact on systemic conditions...”
Implant-prosthetic restorations

The challenge of creating an aesthetically pleasing smile in an edentulous patient

Cristian Petri
Romania

Rehabilitation of the edentulous jaw can be achieved with various treatment modalities. Removable implant-supported overdentures can provide a comfortable, aesthetic and functional option even in cases in which only a limited number of implants can be used. Since the number of patients desiring an alternative to complete dentures is on the rise, this treatment option is becoming a frequent choice.

Patients’ expectations regarding prosthetic tooth replacements are similarly high compared with fixed ceramic veneered restorations. With the emergence of new materials and their combination with CAD/CAM technology, outstanding clinical outcomes can be achieved for this indication. An adequate solution can be found for almost every patient and budget.

Generally, overdentures offer several advantages over conventional removable prostheses, including improved stability, functionality, comfort, confidence in the ability to interact socially, straightforward rehabilitation and easy maintenance for the patient. Quite simply, overdentures result in a significant improvement in the quality of life of the patient.

In our case, a 58-year-old patient presented at the practice with discomfort caused by her complete maxillary denture. When looking at her history, we found a prosthetic restoration retained on six implants in the lower jaw and a complete maxillary denture that was aesthetically and functionally inadequate (Fig. 1). An initial aesthetic evaluation established that the shape and shade of the teeth were inappropriate. In addition, the midline was misaligned and the curvature of the maxillary anterior teeth was shaped incorrectly.

The poor stability of the denture was caused by insufficient prosthetic support and by the method with which it had been produced. Taking the patient’s requirements and financial constraints, as well as the clinical condition of the maxillary prosthetic field, into account, we decided in favour of an implant-supported prosthetic treatment modality. The plan was to insert four maxillary implants to retain an overdenture prosthesis using the double-crown method. This procedure is frequently followed in such cases and has seen constant improvement with the emergence of new technologies and materials.

Our protocol required primary telescope crowns milled from zirconia at an incline of two degrees and secondary copings obtained by electroforming. This approach combines the advantages of zirconia (primary telescopes) with those of hydraulic retention (galvanic copings). After a complication-free period of healing and osseointegration, the four implants were uncovered and a preliminary impression was taken. Also, a customised tray was created from the resulting model.

In order to proceed to the next stage of the treatment, we required a functional impression that would transfer the exact position of the implants. For this purpose, the four impression posts were splinted together on a custom tray with composite material (Figs. 2 & 3). After creating the working models (Fig. 4), we determined the patient’s vertical dimension of occlusion, the length of the future teeth, as well as the gingival smile line, by means of an occlusal plate (bite rim). In the upper jaw, the occlusal rim was shaped in such a way that 2 mm of the edge was visible when the upper lip was in rest position. The lower edge of the rim was aligned parallel to the bipupillary plane and smoothly followed the curve of the lower lip when the patient smiled. On the maxillary rim, the midline, the smile line and the line of the canines were outlined. A facebow was used for the transfer of the maxillary position in relation to the base of the skull.

Once all of the relevant ratios had been obtained, the models were mounted on the articulator (Fig. 5). The difficulty of this case was that the existing mandibular restoration in the design of the maxillary rehabilitation. The implant axes of the mandibular prosthesis in particular posed some problems. Shade selection was dictated by the mandibular restoration and, consequently, our room for decision-making was reduced to deciding on the shape of the teeth. To this end, a photograph of the patient as a young adult was useful, as it was her wish that the shape and size of her teeth as they...
were when she was young should be re-established in the prosthetic reconstruction. With the aim to attain as perfect a prosthesis as possible and to make the most of the available space, we created a wax set-up using prefabricated denture teeth (SR Phonares II, Ivoclar Vivadent). Primary structure
A try-in of the set-up was performed to check the phonetics, aesthetics and occlusion (Fig. 6) and then a silicone key was created over the set-up. This acted as a guide in the subsequent working steps. In order to manufacture the primary structure, the four titanium abutments were customised (Fig. 7), the resulting abutments were scanned together with the model and set-up (double scan), and these datasets were imported into the design software. The CAD program proceeded to suggest the shape, height and angulation of the telescope crowns, which we adjusted and optimised as required (Fig. 8). The primary telescopes were milled from zirconia and sintered to their final density at 1,500°C. After the accuracy of fit had been checked, the zirconia crowns were permanently bonded to the titanium abutments (Multilink Hybrid Abutment, Ivoclar Vivadent). Finally, the zirconia telescopes were adjusted using a laboratory turbine and parabolic logograph. The walls of the telescopes were given a 2-degree incline and smoothed using appropriate diamond grinding tools and sufficient water-cooling (Figs. 9 & 10).

Secondary structure
The primary crowns could now be prepared for manufacturing the secondary crowns, by means of the electroforming technique. For this purpose, the zirconia surfaces were covered in a thin layer of wax to create the space necessary for the cement that would later be used. The secondary structure was invested, cast in a cobalt-chromium alloy using induction casting technology and then finished. The secondary structure was intra-oral cemented on to the electro-formed telescopes (Multilink Hybrid Abutment and Monobond, Ivoclar Vivadent) in order to obtain a tension-free restoration (Fig. 11). Aesthetic design
The structure obtained was covered in an opaque light-curing laboratory composite (SR Nexco, Ivoclar Vivadent) in pink and white to finish the prosthesis. The shape was adjusted in accordance with the requirements of the patient, Final polishing was carried out with biaxial brushes and pads. The result proved very lifelike (Figs. 12-14).

Conclusion
Many patients are reluctant to be given removable dentures. If dentures are optimised by adding the stability of implants and the effectiveness of telescopes, dental professionals will be able to help patients overcome their reservations and offer them a tooth replacement that closely met the expectations of the patient. Final polishing prepared the teeth and prosthetic gingiva for the cement that would later be used. The shape was adjusted in accordance with the requirements of the patient, Final polishing was carried out with biaxial brushes and pads. The result proved very lifelike (Figs. 12-14).

After the injection programme was complete, the flask halves were opened, and the denture divested from the plaster. The pectus were milled with milling and polishing instruments. In order to create a tooth replacement that closely met the expectations of the patient, we decided to customise the visible areas of the denture by applying additional material (SR Nexco). To this end, the vestibular surfaces of the anterior teeth and the corresponding pink parts were sand-blasted. SR Connect (Ivoclar Vivadent) was applied and the teeth and prosthetic gingiva were characterised with SR Nexco. The shape was adjusted in accordance with the requirements of the patient, Final polishing was carried out with biaxial brushes and pads. The result proved very lifelike (Figs. 12-14).

今日の患者は、良い歯科技術者なら限りないことが予想される。それらの患者の要求を満たすためには、自分の患者の要求に適した歯科技術者が必要です。
MiCD: Do no harm cosmetic dentistry—Part I

Dr Sushil Koirala
Nepal

The demand for cosmetic dentistry is a growing trend globally. Increased media coverage, the availability of free online information and the improved economic status of the general public has led to a dramatic increase in patients’ aesthetic expectations, desires and demands. Today, a glowing, healthy and vibrant smile is no longer the exclusive domain of the rich and famous; hence, many general practitioners are now being forced to incorporate various aesthetic and cosmetic dental treatment modalities into their daily practice to meet the growing demand of patients.

Cosmetic dentistry is a science-based art guided by the desire of the patient. Many young clinicians who plan to incorporate it into their practice are confused about what they and their patients actually wish to achieve. It is to be noted that the treatment modalities of any health-care service should be aimed at the establishment of health and the conservation of the human body with its natural function and aesthetics. However, it is worrying to note that the treatment philosophy and technique adopted by many cosmetic dentists around the world tend towards macro-invasive protocols, and millions of healthy teeth are aggressively prepared each year for the sake of creating beautiful smiles.

The practice philosophy adopted by the clinic and the professional team members generally guides the overall output of the practice. Minimally invasive cosmetic dentistry (MiCD), a do no harm practice philosophy, has four fundamental components: level of care, quality of operator (dentist), protocol adopted and technology selected, which must all be re-expected in daily clinical practice. Adopting this holistic medical science practice philosophy is not an easy task, as it requires a change in the mindset of professionals.

In Parts I and II, I explain MiCD, do no harm cosmetic dentistry, based on my Vedic Smile concept, which I have been practising successfully in Nepal for the last 20 years, and advancing globally since 2009 as the MiCD global mission. It is to be noted that both parts are based on fundamental science (truth and available evidence), clinical experience and the common sense required in holistic dentistry.

COSMETIC TRIBUNE

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Cosmetic dentistry, a global trend

The prevalence and severity of dental decay have been declining over the last decades in many developed countries and this trend is shifting towards developing countries as well. With increased media coverage, the availability of free online information, public awareness has fuelled the demand for cosmetic dentistry globally. Now, a glowing, healthy and vibrant smile is no longer the exclusive domain of the rich and famous.1 The population of beauty- and oral health-conscious people is increasing every year and data from various sources shows that the coming generations of children, especially from the middle- to higher-income population, will have fewer decayed teeth and will need less complex restorative dental care as they age. These changing patterns of dental care needs will bring about a major shift in the nature of dental services from traditional restorative care to cosmetic and preventive services.

The increased market demand for smile aesthetics among patients is forcing general practitioners of today to incorporate the art and science of cosmetic dentistry into their practice. Cosmetic dentistry is not yet recognised as a separate clinical specialty like orthodontics, periodontics or paediatric dentistry. Cosmetic dentistry is synonymous with multidisciplinary dentistry, as its success and failure are related to the patient’s psychology, health, function and aesthetics. Ethical, high-standard cosmetic dentistry skill training of clinicians is essential for the increased global market of cosmetic dentistry and its promotion. It is widely seen that the treatment modalities of contemporary cosmetic dentistry are tending towards more-invasive procedures with an over-utilisation of full crowns, bridges, dentine veneers, and invasive periodontal aesthetic surgery, while neglecting long-term oral health, actual aesthetic needs and the characteristics of the patient.2 These aggressive treatment modalities are indirectly degrading social trust in dentistry, owing to the trend of fulfilling the cosmetic demands of patients without ethical consideration and sufficient scientific background and promoting the “the more you replace, the more you earn” or “more is more” mindset in dentistry.3

Changing the professional mindset of the practising clinician is not an easy task; it is just like quitting smoking for a heavy smoker. In order to practice healthy dentistry, one must be groomed, starting from dental school education, with moral values, a high ethical standard, a positive attitude and a patient-centred practice philosophy. A student reflects the mindset of his or her teachers, and a teacher or mentor with comprehensive knowledge, clinical skills, honesty and human- ity is difficult to find in today’s business-oriented dental education. I believe that knowledge...
should be free and skill training must be useful and easily affordable to our young practising clinicians around the world. Compromised university dental education and expensive private skill training with biased mentoring have been promoting health-compromising treatment protocols and costly diagnostic, preventive and treatment technologies. This highly business-oriented trend will promote a change in the mindset of practising clinicians to adopt more aggressive and invasive dental treatment modalities, leading to the practice of unhealthy dentistry in the long term.

Aesthetic versus cosmetic dentistry

The words “aesthetics” and “cosmetic” are viewed as synonyms by many cosmetic dentists. However, it is necessary to understand the core difference in meaning. The Oxford dictionary defines “aesthetics” as “the branch of philosophy which deals with questions of beauty and artistic taste” and “cosmetic” as “improving only the appearance of something”.

In dentistry, “aesthetics” explains the fundamental taste of a person concerning beauty, whereas “cosmetic” deals with the superficial or external enhancement of beauty. Therefore, aesthetic dentistry falls under need-based dental service, and is generally guided by the sex, race and age (SRA factors) of the patient. However, cosmetic dentistry, which is influenced by perception, personality and desires (PPD factors), can be categorised as want or demand-based dental service. For example, a patient’s request to replace old amalgam restorations with tooth-colored restorative materials can be considered an aesthetic requirement or demand. The request for an old woman of pearly white teeth and the ideal smile design is far more than an aesthetic requirement, and must be considered the demand or requirement.

In my clinical practice, I divide aesthetic and cosmetic clinical cases into three different categories:

1. Preventive, or support based: treatment prevents or intercepts the diseases, defects, habits and other factors that may adversely affect the existing or the future smile aesthetics of the patient.
2. Nature-mimetic, or need based: treatment is carried out to restore or mimic the natural aesthetics, bearing the SRA factors of the patient in mind, and the treatment generally enhances the health and function of the oral issue.
3. Cosmetic, or desire based: treatment is performed to enhance or supplement the aesthetic components of the smile; hence, the treatment outcome of cosmetic treatment may not be in harmony with the patient’s SRA factors as in nature-mimetic dentistry, and cosmetic treatment may not necessarily be beneficial to the health and function of the oral issue.

Practice philosophy in dentistry: The mindset

The majority of dental schools around the world focus on teaching knowledge and skills in dental medicine that are based on contemporary dental science and art. Dental school education does not give due consideration to healthy dental practice philosophy according to various factors, such as the right to choose one’s practice philosophy and the dominance of business rather than service-oriented dental practice in the global market. However, quality and healthy clinical practice is always a dream of a good clinician, and establishing such practice requires an unbiased vision, learning, and suffering attitudes, and dedication from the dentist. We must understand that science and art in dentistry have no meaning if practiced by an unethical operator, who does not respect the overall health of the patient. Any scientific advancement in technology has positive and negative sides; hence, if not applied properly, it may adversely affect the profession and may become a threat.

I believe that a clinic or treatment centre must establish its practice philosophy according to its objectives. What a clinician wants and the kind of services he or she wants to deliver to his or her patients guides the clinic. Practically, the practice philosophy in dentistry can be classified into two different categories, depending on the mindset of the operator.

Patient-centred

Clinicians with this kind of mindset generally have a do no harm dental practice (Fig. 1). Professional honesty and humanity are the fundamental principles of such a practice. Operators with this mindset enjoy sharing their clinical knowledge and skills with their professional friends and junior colleagues to promote patient-centred clinical practice in society. This group of clinicians firmly believes in the word-of-mouth approach to practice marketing and always thinks of the patient’s long-term health, function and aesthetics. Clinicians practising no harm dentistry generally are cheerful and healthy in their professional life.

Financially focused

Clinicians with this kind of mindset practise a financially focused dentistry and adopt various kinds of direct marketing approaches to sell their dentistry like a commodity in the market rather than a health care service. Practitioners in this group generally achieve a secure financial position quickly; however, it is frequently seen that they develop chronic stress, burn-out syndrome, depression, frustration and professional guilt, leading to compromised health and happiness in their professional life.

Dentistry and professional stress

Dentistry has long been considered a stressful occupation. Dentists perceive dentistry as being more stressful than other occupations. Dentists have to deal with many significant stressors in their personal and professional lives. There is some evidence to suggest that dentists suffer a high level of occupation-related stress.

A study has found that 85 percent of dentists perceived dentistry as “very stressful” and nearly 60 percent perceived dentistry as more stressful than other professions. Stress can erode varying physiological and psychological responses in an individual. Professional burn-out is one of the possible consequences of ongoing professional stress. The effect of burn-out, although work-related, often will have a negative impact on people’s personal relationships and well-being. Hence, dentists need to take care of their staff’s health and focus on professional happiness in daily practice.

A clinician has full right to adopt the practice philosophy that he or she prefers. However, it is always advisable to apply oneself to understanding, analysing and comparing this philosophy with others. I am very fortunate to have been brought up with the Vedic philosophy of the law of nature and the first, do no harm consciousness-based philosophy in my life at home, at school and in my society. The spiritual guidance and mentoring I received at an early age at home and school have helped me to become a professional with a firm philosophy of do no harm; hence, I started practising consciousness-based dentistry early in my career. During my 21 years of private practice, I have always experienced happiness and joy with high patient satisfaction, which has given me complete confidence and faith in my practice philosophy and the MiCD treatment protocol that I adopt in my practice. Since late 2009, I have been promoting my practice philosophy and clinical protocol in South Asia, and started the MiCD Global Academy in 2012 with the help of like-minded friends, who also practice a similar kind of holistic dentistry around the world. The MiCD Global Academy has a mission to share clinical knowledge and fundamental clinical skills free of charge with all clinicians who desire to practise do no harm cosmetic dentistry for better patient care and to enhance their happiness in their professional life.

Three-way test: Questions for your conscience

Cosmetic dentists can make errors in practice in two ways, first owing to a lack of the required professional knowledge and skills, and second owing to a lack of profes-
Aesthetic components

Micro-aesthetics: deals with the overall structure of the face and its relation to the smile. In order to enhance the aesthetic appeal of the smile, it is essential to maintain the balance between the facial and dental midlines. The aesthetic principles that are applied in MiCD are summarized below.

Macro-aesthetics: deals with the overall structure of the smile. The macro-aesthetic components of the smile are divided into three broad groups: 1. Smiles; 2. Microsmiles; and 3. Macrosmiles.

Table III: Aesthetic components and smile design parameters

<table>
<thead>
<tr>
<th>Ten areas</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Smile self-eval.</td>
<td>Good Satisfactory Compromised</td>
</tr>
<tr>
<td>2. Smile height</td>
<td>Normal Compromised Approached</td>
</tr>
<tr>
<td>3. Kinetic category</td>
<td>Micro Macro</td>
</tr>
<tr>
<td>4. Treatment complex</td>
<td>Simple Complex</td>
</tr>
<tr>
<td>5. Programme</td>
<td>Accepted Modified Changed</td>
</tr>
<tr>
<td>6. Established outcome</td>
<td>Improved No change Deteriorated</td>
</tr>
<tr>
<td>7. Enhancement category</td>
<td>Preventive Non-invasive Cosmetic</td>
</tr>
<tr>
<td>8. Biological cost</td>
<td>None Very low Low High</td>
</tr>
<tr>
<td>9. Biological type</td>
<td>Home &amp; office</td>
</tr>
<tr>
<td>10. Clinical outcome</td>
<td>Good Satisfactory No change</td>
</tr>
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Table IV: The MiCD summary of treatment.

MiCD technical: Rejuvenation, restoration, rehabilitation.

The MiCD technical includes the following four different techniques in MiCD to enhance aesthetic smiles:

1. Macro-aesthetics;
2. Mini-aesthetics;

Conclusion

In practise do no harm cosmetic dentistry, a clinician requires the desire, patience, dedication and will-power to become an honest professional with humanity because honesty and humanity are the pillars of do no harm cosmetic dentistry, since the mind controls all other practices. A dentist must understand that honesty and humanity are not scientific like mechanical knowledge, so it can be learned, copied and applied immediately in the practice. Honesty and humanity are inner qualities of a person and are deeply related to the level of a person’s consciousness, which are generally expressed as habits and attitudes. Therefore, we need to learn these qualities at home and school, and from the profession and society.

Self-evaluation and the realisation of one’s own mistakes that you obtain through your daily professional work is vital to understand and improving to practise do no harm cosmetic dentistry in your practice. 

Editorial note: Complete list of references is available from the publisher.

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Introduction: Smile analysis and aesthetic design

Dental facial aesthetics can be defined in three ways.

Traditionally, dental and facial aesthetics have been defined in terms of macro- and micro-elements. Macro-aesthetics encompasses the interrelationships between the face, lips, gingiva, and teeth and the perception that these relationships are pleasing. Micro-aesthetics involves the aesthetics of an individual tooth and the perception that the colour and form are pleasing.

Historically, accepted smile design concepts and smile parameters have helped to design aesthetic treatments. These specific measurements of form, colour, and tooth/aesthetic elements aid in transferring smile design information between the dentist, ceramist, and patient. Aesthetics in dentistry can encompass a broad area—known as the aesthetic zone.1

Rufenacht delineated smile analysis into facial aesthetics, dental facial aesthetics, and dental aesthetics, encompassing the macro- and micro-elements described in the first definition above.2 Further classification identifies five levels of aesthetics: facial, orofacial, oral, dentogingival, and dental (Tab. I).1, 3

Initiating smile analysis: Evaluating facial and orofacial aesthetics

The smile analysis/design process begins at the macro level, examining the patient’s face first, progressing to an evaluation of the individual teeth, and finally moving to material selection considerations. Multiple photographic views (e.g., facial and sagittal) facilitate this analysis.

At the macro level, facial elements are evaluated for form and balance, with an emphasis on how they may be affected by dental treatment.4, 6 During the macro-analysis, the balance of the facial thirds is examined (Fig. 1). If something appears unbalanced in any one of those zones, the face and/or smile will appear unesthetic.

Such evaluations help determine the extent and type of treatment necessary to affect the aesthetic changes desired. Depending on the complexity and uniqueness of a given case, orthodontics could be considered when restorative treatment alone would not produce the desired results (Fig. 2), such as when facial height is an issue and the lower third is affected. In other cases—not all—restorative treatment could alter the vertical dimension of occlusion to open the bite and enhance aesthetics when a patient presents with relatively even facial thirds (Fig. 3).

Evaluating oral aesthetics

The dentolabial gingival relationship, which is considered oral aesthetics, has traditionally been the starting point for treatment planning. This process begins by determining the ideal maxillary incisal edge placement (Fig. 4). This is accom
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plished by understanding the incisal edge position relative to several different landmarks. The following questions can be used to determine the ideal incisal edge position:

- Where in the face should the maxillary incisal edges be placed?
- What is the proper tooth display, both statically and dynamically?
- What is the proper intra- and inter-tooth relationship (e.g., length and size of teeth, arch form)?
- Can the ideal position be achieved with restorative dentistry alone, or is orthodontics needed?

In order to facilitate smile evaluation based on these landmarks, the rule of 4.2.2—which refers to the amount of maxillary central display when the lips are at rest, the amount of gingival tissue revealed, and the proximity of the incisal line to the lower lip—is helpful (Fig. 3). At a time when patients perceive fuller and brighter smiles as most aesthetic, gingival tissue revealed and proximity of the incisal line to the lower lip is helpful (Fig. 3). When patients perceive fuller and brighter smiles as most aesthetic, gingival tissue revealed and proximity of the incisal line to the lower lip is helpful.\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

### Dentogingival aesthetics

Gingival margin placement and the scalloped shape, in particular, are well discussed in the literature. As gingival heights are measured, heights relative to the central incisor, lateral incisor, and canine in an up/down/up relationship are considered aesthetic (Fig. 6). However, this may create a false perception that the lateral gingival line is incisal to the central incisor. Rather, in most aesthetic tooth relationships, the gingival line of the four incisors is approximately the same line (Fig. 6), with the lateral incisor perhaps being slightly incisal. The gingival line should be relatively parallel to the horizon for the central incisors and the lateral incisors and symmetric on each side of the midline.\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

The gingival contours (i.e., gingival scallop) should follow a radiating arch similar to the incisal line. The gingival scallop shapes the teeth and should be between 4 mm and 5 mm (Fig. 7).\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

Related to normal gingival form is midline placement. Although usually the first issue addressed in smile design, it is not as significant as tooth form, gingival form, tooth shape, or smile line.\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

Several rules can be applied when considering modifying the midline to create an aesthetic smile design:

- The midline only should be moved to establish an aesthetic intra- and inter-tooth relationship, with the two central incisors being most important.
- The midline only should be moved restoratively up to the root of the adjacent tooth. If the midline is within 4 mm of the centre of the face, it will be aesthetically pleasing.
- The midline should be vertical when the head is in the postural rest position.

### Evaluating dental aesthetics

Part of evaluating dental aesthetics for smile design is choosing tooth shapes for patients based on their facial characteristics (e.g., long and dolichocephalic, or squarish and brachycephalic). When patients present with a longer face, a more rectangular tooth within the aesthetic range is appropriate. For someone with a square face, a tooth with an 80 % width-to-length ratio would be more appropriate. The width-to-length ratio most often discussed in the literature is between 75 % and 80 %, but aesthetic smiles could demonstrate ratios between 70 % and 75 % or between 80 % and 85 % (Fig. 8-10).\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

The length of teeth also affects aesthetics. Maxillary central incisors are approximately between 10 mm and 11 mm in length. According to Magne, the average length of an unworn maxillary central to the cementoenamel junction is slightly over 11 mm.\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.} The aesthetic zone for central incisor length, according to the authors, is between 10.5 mm and 12 mm, with 11 mm being a good starting point. Lateral incisors are between 1 mm and a maximum of 2 mm shorter than the central incisors, with the canines slightly shorter than the central incisors by between 0.5 mm and 1 mm (Fig. 11).\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

The inter-tooth relationship, or arch form, involves the golden proportion and position of tooth width. Although it is a good beginning, it does not reflect natural tooth proportions. Natural proportions demonstrate a lateral incisor between 60 % and 70 % of the width of the central incisor, and this is larger than the golden proportion.\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.} However, a rule guiding proportions is that the canine and all teeth distal should be perceived to occupy less visual space (Fig. 12). Another rule to help maintain proportions throughout the arch is 1:2:3:4:5. Finally, contact areas can be moved restoratively up to the root of the adjacent tooth. Beyond that, orthodontics is required (Fig. 16).\footnote{Presented in the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.}

Creating a digital smile designed in Photoshop

Although there are digital smile design services available to dentists for a fee, it is possible to use Photoshop CS5 software (Adobe Systems) to create and demonstrate for patients the proposed smile design treatments. It starts by creating tooth grids—predesigned tooth templates in different width-to-length ratios (e.g., 75 % central, 80 % central) that can be incorporated into a custom smile design based on patient characteristics. You can create as many different tooth grids as you like with different tooth proportions in the aesthetic zone. Once completed, you will not have to do this step again, since you will save the created tooth grids and use them to create a new desired outline form for the desired teeth.

Follow these recommended steps:

1. To begin creating a tooth grid, use a checkerboard image of an attractive smile as a basis (e.g., one with a 75 % width-to-length ratio). Open the image in Photoshop and create a new clear transparent layer on top of the teeth (Fig. 15). This transparent layer will enable the image to be outlined without the work being embedded into the image.
2. Name the layer appropriately and, when prompted to identify your choice of fill, choose “no fill,” since the layer will be transparent, except for the tracing of the tooth grid.
3. To begin tracing the tooth grid, activate a selection tool, move to the tool palette and select either the polygonal lasso tool or the magnetic lasso tool. In the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.
**Determine digital tooth size**

To determine digital tooth size, follow these steps:

- **Create a conversion factor** by dividing the proposed length (developed from the smile analysis) by the existing length.
- **Select a tooth grid** based on a 5:7 ratio (e.g., 80/70/80 or 80/65/80). Open the image of the chosen tooth grid in Photoshop and drag the grid on to the image of teeth to be smile designed.
- **Adjust the size of the grid** so that it appears in the same menu.
- **By tracing several patients’ teeth that have tooth size and proportion in the aesthetic zone** (Fig. 23)
- **Select a tooth grid appropriate for the patient.** Select a tooth grid based on the width-to-length ratio of the tooth (e.g., 80/65/80 or 80/70/80). Open the image of the chosen tooth grid in Photoshop and drag the grid on to the image of teeth to be smile designed (Fig. 27).
- **If the shape of length is deemed inappropriate, press the command button (control button for PCs) and “z” to delete and select a suitable choice.**
- **Depending on the original image size, the tooth grid may be proportionally too big or too small.** To enlarge or shrink the tooth grid created (with the layer activated), press command (or control) and “<” to bring up the free transform function. While holding the shift key (holding the shift key allows you to transform the object proportionally), click and drag a corner left or right to expand or contract the custom tooth grid.
- **Adjust the size of the grid so that the outlines of the central incisors have the new proposed length. Move the grid as necessary using the move tool so that the incisal edge of the tooth grid lines up with the new proposed length (Fig. 28).**
- **Areas of the grid can be individually altered using the liquidity tool (Fig. 29).**

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**Trends & Applications**

**To create a pencil outline of the tooth**, with the transparent layer active, click on the edit mode in the menu bar; in the edit drop-down menu, select “stroke”; choose black for color and 219 pixels for the pen stroke pencil line (Fig. 17), which will create a perfect tracing of your selection. Click “OK” to close the stroke selection. Select (trace with the lasso selection tool) one tooth at a time and then stroke it (Fig. 18). Select and stroke (trace) the teeth up to the second premolar (the first molar is acceptable) (Fig. 19).

**The image should be sized now for easy future use in a smile design.** In the authors’ experience, it is best to adjust the size of the image to a height of 720 pixels (Fig. 28) by opening up the image size menu and selecting 720 pixels for the height. The width will adjust proportionately.

**At this time, the tooth grid tracing will appear, without the image of the teeth, by double-clicking on the layer of the tooth image.** A dialog box reading “no!” will appear; click “OK”. This process unlocks the layer of the tooth so it can be retracted. Drag the layer of the tooth to trash, leaving only the layer with the tracing of the teeth (Fig. 21). If the file menu, click “save as” and choose “.jpg” or “.psd” (Photoshop) as the file type. This will preserve the transparency. You do not want to save it as a JPEG, since depending on the original image size, the tooth grid may be proportionally too big or too small. To enlarge or shrink the tooth grid created (with the layer activated), press command (or control) and “<” to bring up the free transform function. While holding the shift key (holding the shift key allows you to transform the object proportionally), click and drag a corner left or right to expand or contract the custom tooth grid.

**Adjust the size of the grid so that the outlines of the central incisors have the new proposed length. Move the grid as necessary using the move tool so that the incisal edge of the tooth grid lines up with the new proposed length (Fig. 28).**

**Areas of the grid can be individually altered using the liquidity tool (Fig. 29).**

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**Tooth before agreeing to treatment.**

**Create a copy**

To save the information you have created for presentation to the patient, follow these tips:

- **Go to “file” and select “save as”.**
- **When the menu appears, click on the “copy” box.**
- **Name the file at that step.**
- **Save it as a JPEG file type.**
- **Designate where you want it saved.**
- **Click “save”.**

**A file of the current state of the image will be created in the designated area.** You can now continue working on the image and save again at any point.

**Conclusion**

Knowledge of smile design, coupled with new and innovative dental technologies, allows dentists to diagnose, plan, create, deliver aesthetically pleasing new smiles. Simultaneously, digital dentistry is enabling dentists to provide what patients demand: quick, comfortable, and predictable dental restorations that satisfy their aesthetic needs.
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See you at Sino-Dental, Hall B, Booth D51/D60, June 9-12 2015, Beijing