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

VANCOUVER, Canada: The latest report by international market research and consulting group iData Research shows that the Asia-Pacific market for dental prostheses and CAD/CAM devices is currently valued at over US$10 billion. According to the report, the penetration rate of CAD/CAM prostheses has been limited, however, by difficult economic circumstances in Japan, South Korea, Australia and China, among other countries.

In particular, the report showed that the economic recession slowed unit sales growth and that dental laboratories faced budget constraints.

“We are seeing less investment in CAD/CAM systems in many Asia-Pacific countries due to preference for porcelain-fused-to-metal, as opposed to all-ceramic restorations. Dental laboratories increasingly prefer standalone scanner systems as a more affordable option than higher-priced milling systems,” explained iData CEO Dr. Kamran Zamanian. “Standalone scanners will be a large driver for growth in this market, as many companies in the Asia-Pacific region seek to expand their networks of scanners to support their full-in-lab CAD/CAM systems.”

Other growth factors will be pricing pressure owing to more manufacturers entering the market and demographic factors owing to an aging population worldwide, with the resulting demand for dental prostheses.

According to the report, dental company Sirona holds a majority share in the Asia-Pacific CAD/CAM systems market, followed by competitors E4D Technologies, 3M ESPE, SShape, Nobel Biocare, KaVo, Wieland and Roland.

The full report, titled “Asia-Pacific Markets for Dental Prosthetics and CAD/CAM Devices,” can be accessed on iData’s website. [Link]

More teeth, longer life

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. [Link]
AP prominent in global dental schools list

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

The list of top ten dental schools further includes the University of Michigan in the US at number four, KU Leuven in Belgium in fifth place, Tokyo University ranking and a variety of subject rankings. Dentistry is one of the six new additions to the individual subject rankings, bringing the total number of academic disciplines the report covers as of 2015 to 56.

The rankings are based on major global surveys of academics and graduate employers, as well as reference citations data from the literature database Scopus. For the QS World University Rankings by Subject 2015, 85,092 academics and 11,910 graduate employers 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.

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.

Dental Tribune Asia Pacific: The earthquake on 25 April had a devastating effect on your country’s infrastructure and its people. What is the situation currently in Kathmandu, and how have you been affected personally?

Dr Sushil Koirala: The situation in Kathmandu at present remains very difficult owing to the extensive damage to many public buildings, government offices and schools. Nearly 7,500 lives have been lost and 14,500 people have been injured. Those who survived the earthquake are traumatised.

While physically my family and I are fine, we are still pretty much in shock. My children are very distressed because they have been alone at home during the earthquake. The most damaging 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

We are still pretty much in shock

An interview with Nepalese dentist Dr Sushil Koirala

Monk looking at destruction caused by the 25 April earthquake in the Nepalese capital Kathmandu. Damages are estimated at US$340 million. (Photo: Narisandra Shrestha/IRIN)
severely affected areas include the Bhaktapur, Dhading, Dolakha, Kathmandu, Katre, Lalitpur, Nuwakot, Ramechhap, Rasuwa, and Sindulpur 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, 59 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.

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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 as 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 relying on an existing strength of reputation. Through being part of that recognisable brand, patients will know that 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.
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 mouthwash 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 0.1–0.5 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 different 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 Swiss Dental Association co-financed the research, which 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 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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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.

Can the outcome mainly be attributed to the London factor?

Prof. Stephen Dunne: While 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 reorganise 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 conference 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.

"...the conference here has attracted delegates from 29 countries, including from Australia, the US and the Middle East."
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.

Author Info

Naz Haque, aka the Scientist, is Operations Manager at Dental Focus, UK. He has a background in mobile and network computing, and has experience supporting a wide range of blue-chip brands, from Apple to Xerox. As an expert in search engine optimisation, Naz is passionate about helping clients develop strategies to enhance their brand and increase the return on investment from their dental practice websites. He can be contacted at naz@dentalfocus.com.
The importance of pretreatment dental assessments in cancer treatment

Prof. Ansgar Cheng
Singapore

In Singapore, an average of 35 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 dental surgeons and oncologists working together, few realise that they also have an important role to play in the case of patients with other forms of cancer. These can include nose cancer (nasopharyngeal carcinoma), head and neck cancer, and even breast cancer.

In addition to the oncologist and surgeon, the oral specialist should be part of the patient’s care 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 estimated that over 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 dentist 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 any 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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Clearly this was an unwieldy system and in reality it was dis-tilled down to three main types of plaque-associated periodontal diseases: gingivitis, chronic periodontitis and aggressive periodontitis.

While the appropriateness of the terms “chronic” and aggres-sive” 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 patholog-
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 with the desire to proceed with a removable partial 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 esthetically 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 prosthodontic field, into account, we decided in favor 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 appeared at the age of 25 should be reproduced.
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 wax set-liftings prefabricated denture teeth (SR Phunares 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 parallelogram. 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 crown by means of the electroforming technique. For this purpose, the zirconia surfaces were covered in a thin coating of conductive silver using the airbrush technique. Upon completion of the process, the galvanised gold crowns were detached from the telescopes and the conductive silver coating was removed with a solution containing nitric acid. In the process, a highly accurate secondary structure was obtained.

Tertiary structure

All of the components were repositioned on to the working model. Before the tertiary structure was fabricated, the electroformed crowns were covered in a thin layer of wax to create the space necessary for the cement that would later be used. The tertiary structure was invested, cast in a cobalt–chromium alloy using induction casting technology, and then finished. The tertiary structure was intra-orally cemented on to the electroformed 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. Again, the silicone key was used as a guide. The SR Phunares II teeth were repositioned from the wax set-up to the framework. The occlusal parameters were checked again and then we proceeded to complete the restoration. In order to reconnect the pink gingival portion, we used the Ivoflase Injector system (Ivoclar Vivadent). The lingual design was invested in two specially designed flask halves using Type III and IV plaster. After removing the wax and isolating the plaster surfaces, we prepared an Ivoflase capsule and placed it together with the flask into the polymersisation chamber. The Ivoflase injection and polymerisation process is fully automated and takes about 60 minutes. Users can choose between two programme options. Running the standard programme takes about 40 minutes. If the RMR programme is additionally activated, the pressing time increases, as a result of which the monomer concentration is reduced to less than 1 per cent. This aspect is beneficial to patients because the risk of allergies and irritation of the mucous membrane is virtually eliminated.

After the injection programme was complete, the flask halves were opened, and the denture divested from the model. The denture was then finished 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 Con (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. 12–15).

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 meets the expectations of patients who require fixed restorations. However, some of these requirements are more difficult to satisfy in the edentulous patient, because we have to replace soft tissue in addition to missing teeth. In order to achieve this, we need to find a way to create harmony between the pink and white aspects of the denture. Today’s patients tend to be well informed. They have ever higher expectations of the aesthetic and functional aspects of tooth replacement. Therefore, we need to be well trained and know which materials and technologies can aid our work and increase our efficiency. This will enable us to solve any clinical case, regardless of its difficulty.
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 practices 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-evaluated 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 dentistry, a global trend

The popularity 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. Increased media coverage, the availability of free online information, public awareness has fuelled the demand for cosmetic dentistry globally.1 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.2

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 practise 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 “aiming 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 categorized 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 for pearly white teeth and the ideal smile design is far more than an aesthetic requirement, and must be considered a cosmetic 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
2. Naturo-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 tissue.
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 tissue.

**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 owing to various factors, such as the rights to choose one’s practice philosophy and the domination 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 serving 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 do no harm dentistry are generally cheerful, happy and healthy in their professional life.

**Financially focused**

Clinicians with this kind of mindset pursue 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.5 Stress can elicit varying physiological and psychological responses in a person. 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.15–20 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 as a child, at school and in my society. The spiritual guidance and mentorship 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 apply 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 practise 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 professional...
In 2002, the FIH World Dental Federation endorsed the approach of minimal intervention dentistry, which has its roots in the conservative management of carious lesions, applying the concept of "non-invasive caries management and decay repair model". History clearly shows that, since Dr G.V. Black era to the present day, we have been applying the concept of "extension in dentistry" in the name of prevention, retention, function, aesthetic need and conservation, to reduce their caries removal. It is a clinical fact that this concept will remain the focus because it has been widely recognised as a different, as its treatment modalities are guided by multifactorial issues such as patient factors (mind, body, behaviour and surroundings), operator factors (knowledge, skills, honesty and humanity), protocol factors (the truth, evidence, experience and common sense), technical factors, cost and biological cost, and affinity and simplicity). The use of science and technology requires continuing education in operators and awareness in patients; hence, the operator must use his or her professional knowledge and skills with the patient's willingness to select the least invasive procedure, protocol and technology in treatment, so that the treatment in dentistry is always minimal, safe and healthy.

The invasiveness of procedures selected in cosmetic dentistry depends on the level of smile defect, type of smile design, proposed treatment types and treatment complexity. MiCD uses the most conservative and least intervention procedure possible. The level of invasiveness in cosmetic dentistry can be classified into four categories, namely non-invasive, micro-invasive, minimally invasive, and invasive, and the treatment options, various treatment procedures and their biological cost for each are presented in Table 1. There are only one principle for the establishment of the treatment modalities in MiCD: always select the least invasive procedure as the best cosmetic treatment. Treatment procedures mentioned under non-invasive, micro-invasive and minimally invasive are used selectively in MiCD.

MiCD treatment protocol and clinical technique
Minimal invasive dentistry was developed over a decade ago by restorative experts and founded on sound evidence-based principles. In dentistry, it has focused mainly on prevention, re-conservation and minimal dental intervention in caries management and not given sufficient attention to the other health problems. For this reason, I developed the MiCD concept and its treatment protocol in 2006, which integrates the evidence-based minimal invasive philosophy into aesthetic dentistry. The hope that will help practitioners achieve optimum results in terms of health, function and aesthetics with minimal intervention treatment and optimum patient satisfaction. The MiCD concept and treatment protocol are explained in an article titled "Minimal invasive cosmetic dentistry—Concept and treatment protocol" in the current issue of the Journal of the Hong Kong Dental Association, the concept is an aesthetic, and in aesthetic dentistry, the concept of the "Hollywood smile" was introduced, which establishes the concept of "extension for cosmetics" in dentistry.

Trends & Applications

Aesthetic components

Table IV: The MiCD summary ten.

<table>
<thead>
<tr>
<th>Ten areas</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Smile evaluation</td>
<td>Good</td>
</tr>
<tr>
<td>2. Esthetic factors</td>
<td>Normal</td>
</tr>
<tr>
<td>3. Aesthetic category</td>
<td>Micro</td>
</tr>
<tr>
<td>4. Treatment complexity</td>
<td>Simple</td>
</tr>
<tr>
<td>5. Established outcome</td>
<td>Improved</td>
</tr>
<tr>
<td>6. Establishment of esthetics</td>
<td>Natural</td>
</tr>
<tr>
<td>7. Contour</td>
<td>Adjacent</td>
</tr>
<tr>
<td>8. Biological cost</td>
<td>None</td>
</tr>
<tr>
<td>9. Exit remark</td>
<td>Good</td>
</tr>
<tr>
<td>10. Clinical success</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

MiCD summary ten. After completion of any MiCD clinical case, patients are always satisfied and the clinical success must be evaluated. In order to evaluate the clinical cases comprehensively and practically, in the MiCD protocol, a clinician is advised to always summarise all the treatment in the ten areas listed in Table IV, called the MiCD summary ten.

Conclusion

In order to practise do no harm cosmetic dentistry, a clinician requires the desire, passion, 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 practice factors. A clinician must understand that honesty and humanity are not scientific like knowledge and skills, but must 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 the MiCD concept is an assessment that you obtain through your daily professional work is vital to understand and beginning to practise do no harm cosmetic dentistry in your practice.

S. K. Koidala, D.S.Williams, and S. K. Koidala, D. Williams

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Editorial note: Complete list of references is available from the publisher.
Smile analysis and photoshop smile design technique

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.

Histologically, 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.

Rufenacht delineated smile analysis into facial aesthetics, dental aesthetics, and the relationships between the face, lips, gingiva, and teeth in terms of macro- and micro-elements described in the first definition above. Further classification identifies five levels of aesthetics: facial, orofacial, oral, dentogingival, and dental (Table 1).

At the macro level, facial elements are evaluated for form and balance, with an emphasis on how they may be affected by dental treatment. 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 enhance facial and aesthetic esthetics when a patient presents with relatively even facial thirds (Fig. 1).

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,6 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.6-8 The gingival contours, see no more than 2 mm of gingiva when the patient is full smiling is ideal. Finally, the incisal line should come very close to and almost touch the lower lip, being no more than 2 mm away.4 These guidelines are somewhat subjective and should be used as a starting point for determining proper incisal edge position.

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 ginvival line is incisal to the central incisor. Rather, in most aesthetic tooth relationship, the ginvival line of the four incisors is approximately the same line (Fig. 6), with the lateral incisor perhaps being slightly incisal.8 The ginvival line should be relatively parallel to the horizon for the central incisors and the lateral incisors and symmetric on each side of the midline.4-8 The ginvival contours (i.e., ginvival scallop) should follow a radiating arc similar to the incisal line. The ginvival scallop shapes the teeth and should be between 4 mm and 5 mm (Fig. 7).

Related to normal ginvival 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.

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 70% of the width of the central incisor, and this is larger than the golden proportion.11 However, a rule guiding proportions is that the canine and all teeth 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. The lateral incisor is two-thirds of the central incisor and the canine is four-fifths of the lateral incisor, with some latitude within those spaces (Fig. 13). Finally, contact areas can be moved restoratively up to the root of the adjacent tooth. Beyond that, orthodontics is required (Fig. 14).

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—presigned 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 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:

To begin creating a tooth grid, use a cheek retracted 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 with out the work being embedded into the image.

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.

To begin tracing the tooth grid, activate a selection tool, move to the “Polygonal Lasso Tool,” 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.
To determine digital tooth size
To determine digital tooth size, follow these steps:

- Create a conversion factor by dividing the proposed length (measured in the mouth or on the image) by the conversion factor (e.g., 70/80/90 or 80/60/80). Open the image of the teeth, by double-clicking on the central incisor.

- 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 selection tool), press command (or control) and “t” to bring up the free transform function. While holding the shift key (holding the shift key down in front of the number line form), click the command button (control button for PCs) and “z” to delete and select a suitable choice.

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

  - Select the eyedropper palette. A new menu will appear. Select the ruler tool (Fig. 23).
  - Click and drag the ruler tool from the top to the bottom of the tooth to generate a vertical line, number in this case 170 pixels (Fig. 24). Multiply the number of pixels by the conversion factor. In this case, 170 x 1.29 = 219 pixels (219 pixels digitally equivalent to 11 mm (Fig. 25)).

- Use the forward warp tool by clicking on an area of the existing tooth and dragging to mold/shape the tooth into the shape of the new proposed outline (Fig. 26).

- Adjusting tooth brightness

  The following steps are recommended next:

  - Select the whitening tool (dodge tool) to brighten the teeth. In the dodge tool palette, click on “midtones” and set the exposure to approximately 20%.

- Performing the changes on the patient, you can use the brightness adjustment in the brightness/contrast menu; click “image > adjustment > brightness/contrast”.

- The Photoshop smile design technique

  The Photoshop Smile Design (PSD) technique can be done on any image, and images can be combined to show the full face or the lower third with lips on or lips off. This article demonstrates how to perform the technique on the cheek-retracted view.

  The first step in the PSD technique is to create a digital conversion of the actual tooth length and width, and then digitally determine the proposed new length and proportion of the tooth.

  Determining 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 of the tooth.

- The patient’s tooth can be measured in the mouth or on the scan (Fig. 22). If the length measures 8.5 mm but needs to be at 11 mm for an aesthetic smile, divide by 8.5. The conversion factor (Fig. 29), a 29% digital increase lengthwise.

- Open the full-screen cheek-retracted view in Photoshop and zoom in on the central incisor.

- Select the eyedropper palette. A new menu will appear. Select the ruler tool (Fig. 23).

- Click and drag the ruler tool from the top to the bottom of the tooth to generate a vertical number, in this case 170 pixels (Fig. 24). Multiply the number of pixels by the conversion factor. In this case, 170 x 1.29 = 219 pixels, digitally equivalent to 11 mm (Fig. 25).

- Determine the digital tooth width using the same formula (Fig. 19).

- Create a new layer, leave it transparent, and mark the measurement with the pencil tool (Fig. 26).

- Applying a new proposed tooth form

  Next, follow these steps:

  - After performing the smile analysis and digital measurements, choose a custom tooth grid appropriate for the patient. Select a tooth grid based on the width-to-length ratio of the teeth planned with (e.g., 80/70/90 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 (Fig. 27).

- If the shape or length is deemed inappropriate, press the command button (control button for PCs) and “z” to delete and select a suitable choice.

- To enlarge or shrink 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, and 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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