MiCD: Do no harm cosmetic dentistry

By 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 growing 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 techniques 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 increased global market of cosmetic dentistry globally. Now, a glowing, healthy and vibrant smile is no longer the exclusive domain of the rich and famous. 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.

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. 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 recognized 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 aesthetic and cosmetic dental treatment protocols and clinical “10 R” Technique. Changing the professional mindset of the practicing clinician 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 clinical experience and the common sense required in holistic 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 appearances 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 (PFD factors), can be categorised as want or demand-based dental service. For example, a patient's request to replace old amalgam restorations with tooth-coloured restorative materials can be considered an aesthetic requirement or demand. The request of an old woman for purely 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 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 tissue.

3. Cosmetic, or desire-based: treatment is performed to enhance or supplement the aesthetic components of the smile; hence, the treatment outcome cosmetically 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 towards various factors, such as the need 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 or non-professional clinician, 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. I). 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 believe in the word-of-mouth approach to practice marketing and always thinks of the patient’s long-term health, function and aesthetics. Clinicians practicing do no harm dentistry are generally cheerful, happy and healthy in their professional life.

Financially focused

Clinicians with this kind of mindset practice 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 occupational related stress. A study has found that 83 per cent of dentists perceived dentistry as “very stressful” and nearly 60 per cent perceived dentistry as more stressful than other professions. Stress can elicit varying psychological and physiological 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 peoples personal relationships and well-being. Hence, dentists need to take care of their 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 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 conscious-based philosophy in my life at home, 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 25 years of professional practice, I have 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 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 lives.

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 honesty and humanity. The first one can be eliminated with good education and proper training, but the second one demands a total shift in mindset, with a high level of consciousness in professional ethics, attitudes and respect towards the patients long-term health, function and natural beauty.

I apply a simple yet very powerful test to keep myself stress- and guilt-free and within the boundaries of professional ethics, honesty and humanity when proposing a dental treatment plan to my patient. Clinicians can apply the three-way test

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**Table I:**

<table>
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**Figure 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.

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**Figure 2:** A clinician has full right to adopt the practice philosophy that he or she prefers. However, it is 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 conscious-based philosophy in my life at home, 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 25 years of professional practice, I have 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 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 lives.
mentioned below just by taking a deep breath and closing their eyes for a while to allow your conscience to respond positively to all the questions, then it is advisable for you to propose the treatment plan and take up the treatment if you give negative responses to the questions, then you should rethink your proposed treatment plan and consult your patient's long-term health, function and aesthetics using a more sensible and less destructive approach.

The three-way test consists of three basic questions:

1. Would I use this treatment for a member of my own family in this situation?
2. Am I competent enough to take up this case?
3. Will the patient be happy with the biological, financial and time costs of the proposed treatment?

I have been using this simple test since my early days of practice and enjoying every moment of my clinical practice without any mental stress and sleepless nights. It is also an act of moral guilt. Moreover, I have found that the end-result of my case has always brought happiness to me and to the entire supporting team with high patient satisfaction. During all my MiCD workshops and training workshops and seminars, I always encourage my trainees and audience to enhance the quality of their operator factors (knowledge, skills, honesty and humanity) because it is the pillar of successful MiCD. It is my personal belief that a clinician adopts a habit of testing his or her treatment plan with the three-way test before proposing it to the patient so it could help him or her to promote overall happiness in his or her practice with high patient satisfaction.

Extension: Invasive dentistry

If we look carefully at the history of restorative dentistry, the word “extension” (or “invasive”) has always been a point of focus among clinicians.14 The concept of “extension for prevention and retention” was pronounced by Dr G.V. Black 100 years ago and it was used to enhance the longevity of restoration materials available at that time. However, with the development of porcelain-fused-to-metal technology in the late 1990s, the concept of “extension for functional aesthetics” was advocated which is stiflingly popular in clinical practice. In the early 1990s, the concept of the “Hollywood smile” was introduced, which established the concept of “extension for cosmetics in dentistry.”

In 2002, the FDI World Dental Federation endorsed the approach of “minimum invasive dentistry,” which has basically focused on the conservative management of carious lesions, applying the concept of “minimum invasive dentistry” and avoiding excessive caries removal. 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 cosmetic desire, and caries removal. It is a clinical fact that the extent of caries will remain the focus because each clinical situation is 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), technology factors (health, reliability, affordability and simplicity). The use of science and technology requires consciousness in operators and awareness in patients, because the operator must use his or her professional knowledge and skills with honesty and humanity to do the least invasive procedure, protocol and technology in treatment, so that extension 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 and patient's personality and treatment complexity. MiCD uses the most conservative smile enhancement procedure possible. The level of invasiveness in cosmetic dentistry can be classified into four types, namely non-invasive, micro-invasive, minimally invasive and invasive, and the treatment options on various treatment procedures and their biological cost for each case are presented in Table I. There is only one principle in selecting treatment modalities in MiCD—always select the least invasive procedure as the choice of the treatment.18 Treatment procedures mentioned under non-invasive, micro-invasive and minimally invasive are used selectively in MiCD.

MiCD treatment protocol and clinical technique

Minimally invasive dentistry was developed over a decade ago by restorative experts and founded on sound evidence-based principles.19 In dentistry, it has focused mainly on prevention, remineralisation and minimal dental intervention in caries management and has not interfered with other health problems. For this reason, I developed the MiCD concept and its treatment protocol in 2003. This technique integrates the evidence-based minimally invasive philosophy into aesthetic dentistry in the hope that it will help practitioners achieve optimum results in terms of health, function and aesthetics with minimum treatment intervention and optimum patient satisfaction. The MiCD concept and treatment protocol are explained in an article titled “Minimal invasive aesthetic dentistry—Concept and treatment protocol.”19 In this current article, I discuss the MiCD core principles (Fig. 1), MiCD treatment protocol and clinical technique briefly (Fig. 2).

MiCD clinical technique: Rejuvenation, restoration, rehabilitation and repositioning.

The MiCD clinical technique focuses on the aesthetic pyramid of the Smile Design Wheel (Fig. 3). Aesthetic components in dentistry are divided into three broad groups:

1. macro-aesthetics,
2. mini-aesthetics, and
3. micro-aesthetics.

Each aesthetic group deals with different aesthetic components (Table III and VII) and each component must be harmonized at the end of treatment according to the smile defect and patient's desire. There are four different techniques in MiCD to enhance smile aesthetics:

1. Rejuvenation: to rejuvenate in MiCD to enhance smile aesthetics with minor modifications in tooth position, colour and form, also known as the MiCD ABC (principle), namely align, brighten and contour (Figs 4–9).
2. Align: minor discrepancies between the facial and dental midlines are acceptable in many instances.10 However, a cantered line would be more obvious27 and therefore less acceptable in cosmetic dentistry. Similarly, the disharmony in natural progression of axial inclination or the degree of tipping of anterior teeth affects the smile. The correction to the midline and axial inclination procedure11 involves an active movement of anterior tooth position. These are carried out using cosmetic orthodontic materials, brackets or removable aligners. Once the anterior teeth are in an aesthetically acceptable position, the aesthetic concern of the patient generally decreases towards the colour enhancement of the dentition. It is to be noted that a well-aligned tooth generally requires no or less tooth preparation during tooth contour (shape and size) modification. This helps the clinician to achieve aesthetic smiles with micro- or minimally invasive procedures with a very low biological cost.
3. Brighten: tooth bleaching or colour modification in MiCD is carried out once teeth are in acceptable alignment but before the tooth form is modified. The level of tooth colour modification depends on the quality of the existing colour of the dentition and the patient's desire. Home and office bleaching are popular methods for modifying tooth colour. However, in some cases, procedures such as remineralisation, micro-abrasion, walking bleach and thin enamel veneers are used.
4. Contour: a contour is an outline of the shape or form of something.9 In dentistry, cosmetic contouring entails reshaping teeth or gingivae to an aesthetic form. Cosmetic contouring can be performed in two ways, additive and subtractive. Additive cosmetic contouring entails shading the tooth form using tooth-coloured restorative materials, such as a resin composite (direct treatment) or porcelain (indirect treatment) or ceramic (veneers), and changing the gingival shape using graft materials. Subtractive cosmetic contouring entails removing dental tissue by grinding or texturing, and gingival tissue by selective surgical procedures—which are non-reversible in nature and so proper care must be taken.

Rejuvenation is a process of replacing missing dental tissue to enhance health, function and aesthetics. Restoration is performed using micro-to-minim invasive treatment materials such as composite resins, veneers, inlays, onlays or adhesive pontics, depending upon the extent and severity of the smile defect (Figs 10A & 10B–C).

3. Rehabilitation: rehabilitation is the process of complete reconstitution of the tooth to enhance psychology, health, function and aesthetics using micro- or minimally invasive treatment options when the damage is more severe and the possible biological cost. Direct and indirect composite resins and esthetic porcelain are the materials of choice for rehabilitation in MiCD (Figs 12–14).

4. Repair: the role of repair in restorative dentistry is very important. The restoration cycle or each restorative procedure increases the size of the smile defect by superimposing perer-repair restoration. Hence, MiCD protocol recommends performing repair wherever aesthetically appropriate and possible using micro- or minimally invasive materials so that the health of the oral tissue will not be compromised, while maintaining function and aesthetics (Figs 15–16).

Conclusion

In order to practice 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. The clinician must understand that aesthetic human personality is not scientific like knowledge and skills, which 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 school and from the profession and society.

Self-evaluation and the realisation of the level of inner happiness that you obtain through your daily professional work will define understanding and beginning to practice no harm cosmetic dentistry in your practice.

Editorial note: A complete list of references is available from the publisher.
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 the colour and form 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.

Hufnacht delineated smile analysis into facial aesthetics, dentofacial aesthetics, and dental aesthetics, encompassing the macro- and micro-elements described in the first definition above. Further classification identifies the levels of aesthetics: facial, orofacial, dental, gingival, and maxillofacial.

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 the patient’s face and orofacial relationships. Multi-perspective and sagittal photographic views (e.g., facial, dental) 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. During the macro-analysis, the balance of the facial thirds is examined. 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, such as when facial height is an issue and the lower third is affected. In other cases—but 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.

Facial aesthetics

Table I: Components of smile analysis and aesthetic design.

<table>
<thead>
<tr>
<th>Facial aesthetics</th>
<th>Total facial form and balance</th>
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<tbody>
<tr>
<td>Orofacial aesthetics</td>
<td>Maxillomandibular relationship to the face and the dental midline relationship to the face pertaining to the teeth, mouth, and gingiva</td>
</tr>
<tr>
<td>Oral aesthetics</td>
<td>Labial, dental, gingival, the relationships of the lips to the arches, gingiva, and teeth</td>
</tr>
<tr>
<td>Dentogingival aesthetics</td>
<td>Relationship of the gingiva to the teeth collectively and individually</td>
</tr>
<tr>
<td>Dental aesthetics</td>
<td>Macro- and micro-aesthetics, both inter- and intra-tooth</td>
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The midline only should be moved—name the layer appropriately and, to begin creating a tooth grid, use a selection to better fit the grid shape. Where in the face should the maxillary incisal edge placement be ideal? In an aesthetic smile, see approximately 4 mm of maxillary central incisor length, as most aesthetic, bright smiles are within 4 mm of the centre of the root of the adjacent tooth, if the midline is within 3 mm of the center of the incisal line, it will be aesthetically pleasing.

Dentogingival aesthetics

Gingival margin placement and the scalloped shape, in particular, are well discussed in the literature. As gingival heights are measured relative to the central incisor, lateral incisor, and canine in an up/down/up relationship, they are considered aesthetic. 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). However, this is orthodontic work being slightly incisal. The gingival line should be relatively parallel to the horizon for the central incisors and lateral incisors and symmetric on each side of the midline. 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 about 4 mm and 3.5 mm (Fig. 7).

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. 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 to better fit the grid shape. When the midline is within 3 mm of the central incisor, the canines slightly shorter than the central incisors by between 0.5 mm and 1 mm (Fig. 11).

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. However, 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. 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 digitalsmile designed in Photoshop

Although there are digital smile design services available to dentists for a fee, it is possible to use Photoshop CS6 software (Adobe Systems) to create and demonstrate for patients the proposed smile design treatments. It starts by creating tooth grids—pre-designed 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:

- 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 tooth (Fig. 15). This transparent layer will enable the image to be outlined without 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 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.
- To create a pencil outline of the tooth, with the transparent layer active, click on the edit menu in the menu bar, in the edit drop-down menu, select “stroke”; choose black for colour, and select a two-pixel stroke pencilline (Fig. 17) which will create a perfect tracing of your selection. Click “OK” to stroke the selection. Trace with the lasso selection tool one tooth at a time and then stroked (Fig. 18). Select and stroke (trace) the teeth on the top left second premolar (the first molar is acceptible) (Fig. 19).
- The image should be sized now for easy future use in a smile design. In the author’s experience, it is best to trace the size of the image to a height of 720 pixels (Fig. 20) 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 can be saved, without the image of the teeth, by double-clicking on the layer of the tooth image. Adobe box making “new layer” will appear, click “OK.” This process unlocks the layer of the teeth so it can be removed. Drag the layer of the teeth to the trash, leaving only the layer with the tracing of the teeth (Fig. 21). In the file menu, click “save as” and choose “.png” or “.psd” (Photoshop) as the file type. This will preserve the transparency. You “save as” and choose the appropriate file type (e.g., .75% S.W.I. central).
- By tracing several patients’ teeth that have tooth size and proportion in the aesthetic zone and saving them, you can create a library of tooth grids to custom design new teeth for your patients who require smile designs.

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 whole face. In one 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, width, and shape. Using the tooth grid, determine the proposed new length and proportion of the teeth.

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 of the tooth.
  - The patient’s tooth can be measured in the mouth or on the cast (Fig. 22). If the length measures 8.5 mm but needs to be at 11 mm for an aesthetic smile, divide it by 8.5. The conversion factor equals 1.29, a 29% digital increase lengthwise.
  - Open the full arch cheek-retracted view in Photoshop, and zoom in on the central incisor.
  - Select the eyedropper palette.
  - A new menu will appear. Select the rulers 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; 219 pixels is digitally equivalent to 1 mm (Fig. 25).
  - Determine the digital tooth width with the same formula.
  - 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 planned teeth (e.g., 80/70/90 or 80/69%). Open the image of the chosen tooth grid in Photoshop and drag the grid onto the image of the teeth to be smile-designed (Fig. 27).
    - If the shape or length is deemed inappropriate, press the command button (control button for PC) 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 “t” 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 liquify tool (Fig. 29).
- Digitally creating new aesthetic teeth
  - Next, follow these suggested steps:
    - With the new tooth grid layer and the magic wand tool both activated, click on each tooth to select all of the teeth in the grid (Fig. 30).
    - Expand the selection by two pixels; with the selection menu, click “select” and “expand” (Fig. 31).
    - Note that the select better enhances the grid. You can expand the selection or contract as necessary using the same menu.
    - Activate the layer of the teeth (cheek-retracted view) by clicking on it (Fig. 32).
    - Next, apply the liquify filter (you will see a red mask around the shapes of the proposed teeth). The mask creates a digital limit that the teeth cannot be altered beyond. This is similar to creating a mask with tape for painting a shape (Fig. 33).
    - 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 form (Fig. 34).
  - Repeat this for each tooth. If you make a mistake or do not like something, click command (or control) and “z” to go back to the previous edit (Fig. 35).

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 “mid-tone” and selected the exposure to approximate 1%. Click on the areas of the tooth you want brightened (Figs. 36 & 37).
  - Alternatively, with the teeth selected, you can use the brightness adjustment in the brightness/contrast menu, click “image” and “adjustments” brightness/contrast.
  - Performing the changes on only one side of the mouth allows the patient to compare the new smile design to his/her original teeth 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.
  - Signate where you want it saved.
  - Click “save”.

A file of an image is created in the designated area. You can now continue working on the image and save again at any point you want.

Conclusion
- Knowledge of smile design, coupled with new and innovative dental technology, allows dentists to diagnose, plan, create, and deliver aesthetically pleasing new smiles. Simultaneously, digital dentistry is enabling dentists to provide what patients demand—quick, comfort-able, and predictable dental restorations that satisfy their aesthetic needs.
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