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The Practice of MiCD: From Unconscious to Conscious

The demand for cosmetic dentistry has increased significantly over the past decade due to increased awareness, marketing and disposable incomes. Healthy and "virgin" teeth are often aggressively prepared during "smile makeovers - instant orthodontics" without patients being educated on risks, complications and longevity. Most smile makeovers are performed between ages 30 to 40 when patients are better able to afford it. Based on a mean service length of 8 to 10 years, most patients would have to undergo 4 to 5 replacement cycles in a lifetime. Each replacement cycle is usually more complex and costly than the previous one due to recurrent caries, gingival recession, pulp death, tooth loss etc. It is therefore prudent that a "conscious" effort be made to adopt a minimally invasive mindset to cosmetic dentistry (Minimally Invasive Cosmetic Dentistry –MiCD approach) where the least amount of dentistry is performed and any removal of tooth structure is kept to an absolute minimum to achieve good aesthetic outcome.

The MiCD approach preserves tooth structure, prolongs tooth longevity, reduces treatment cost / number of replacement cycles in a lifetime, increases patient's confidence / trust as well as enhances the image of the profession. A paradigm shift from the "unconscious" to "conscious" as well as "periodic" to "persistent" practice of MiCD is particularly important in Cosmetic Dentistry as aesthetic dental procedures are usually elective in nature and posses higher litigation risks. The MiCD mindset needs to be inculcated from Dental School. Similar minimally invasive models already exist for periodontal disease / caries and can be modified and applied to aesthetic problems causing "Dis-Ease" to patients. A problem-based curriculum involving specific dental aesthetic problems (e.g. discolored / worn / poorly shaped / crooked teeth or spaces between teeth) established on MiCD would be helpful for students to consolidate principles and appreciate fully the advantages of adopting a conservative and minimally invasive approach. Non-invasive and minimally invasive treatment options should always be considered prior to initiating more invasive ones. As part of MiCD treatment planning, discussion of quality of life issues focusing on patients' wants, needs and expectations must also be considered.

This issue of MiCD features an exclusive interview with Dr.Peter Dawson, an eminent clinician and academician who has contributed significantly in the field of occlusion. We have also selected various clinical articles related to cosmetic dental restoration so as to make this issue interesting and informative for the readers.

We hope our efforts to emphasise the concept of minimal invasive restorative procedures will be beneficial in your clinical practice to satisfy the aesthetic expectations and overall wellbeing of your patients.

Most smile makeovers are performed between ages 30 to 40 when patients are better able to afford it. Based on a mean service length of 8 to 10 years, most patients would have to undergo 4 to 5 replacement cycles in a lifetime. Each replacement cycle is usually more complex and costly than the previous one due to recurrent caries, gingival recession, pulp death, tooth loss etc.

Dr. Adrian Yap
Editor-in-chief

To Merge Minimally Invasive and Comprehensive Dentistry: Look beyond the Teeth

[1]James Beck

Abstract

Minimally invasive techniques can be applied to a wide variety of cases, even those requiring extensive restoration. But minimally invasive cosmetic dentistry should not solely be confined to treating the teeth. A conservative approach to restorative dentistry should not fail to recognize the extent of a patient's dysfunction. The ultimate goal should be to restore as much functional capacity as possible with the least invasive approach. This requires a comprehensive diagnosis and a thoughtful treatment plan that considers more than just the teeth. It is important to evaluate the masticatory system as a whole before undertaking any dental treatment because when treatment is carried out with cosmetic considerations only, it may lead to more invasive treatment over of time. The ultimate success of minimally invasive dentistry techniques depends on the operator making a pre-treatment comprehensive diagnosis, but dentists do not always use objective methodology to quantify occlusal function. Electrodiagnostics are an important and vital adjunct for comprehensive diagnosis of masticatory system. Joint Vibration Analysis (JVA), Electromyography (EMG) and Electognathography (Jaw Tracker) are accurate diagnostic tools that aid in the making of a comprehensive diagnosis.

Key words: JVA, JT-3D, BioEMG III ,MICD. musculo-skeletally stable occlusion, masticatory function, weakest link, comprehensive diagnosis, temporomandibular joint function, muscle function, individualized treatment plan

Correspondence:

[1]James Beck,

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Learning objectives

The reader will see the benefits of combining the concepts of minimally invasive techniques and comprehensive diagnosis. The importance of improving masticatory function to the more commonly aimed goal of achieving acceptable aesthetics has been discussed in this article. It is important to recognize that every patient is a unique individual with their own specific concerns and conditions. The best treatment plan is the one that most closely meets the individual's needs.

Introduction

The concept of minimally invasive dentistry is fast becoming an important concept in modern dentistry. Essentially, it means that while treating patients, clinicians need to be conservative when restoring the dentition. However, this concept of conservatively intervening can also be applied in the context of diagnosing and treating the complete masticatory system as a whole.

Achieving a stable masticatory system;

1. with the best possible function and
2. using the least invasive techniques should be the goals whenever one is restoring a dentition.

Dentists need to be cognizant that changes in tooth structure volume that alter the occlusion, can often be related to change in other parts of the masticatory system. These subtle changes can lead to facial pain and dysfuncton.[1]

The temporomandibular joints are the skeletal foundation of the masticatory system. During function as well as parafunction, the loading of the joints can be altered by an alteration of the occlusal surfaces of teeth. Moreover, it's not only the teeth which define the occlusion. Another critical factor which defines the "occlusion" is the maxillomandibular relationship.[2] And, because the masticatory muscles also have a significant role in the loading and operating of the stomatognathic system, in addition to the teeth themselves, both the joints and the muscles require evaluation before undertaking any significant dental treatment.[3] The success of MICD procedures involving resins, ceramics, or even occlusal adjustments, depends upon the extent that an equilibrium is being restored within the masticatory system.

The masticatory muscles are the most adaptive parts of the masticatory system.[4] Muscles alter their length activity to obtain balance or equilibrium when the system is disturbed due to an unstable musculoskeletal position during maximum intercuspation. However, muscles can pay a price when functioning too far away from their resting length, often causing further changes within the joints and/or the dentition.

With regard to the temporomandibular joints, it is important to determine if the articular surfaces of the joints are properly lined by dense fibro-cartilage connective tissue (mostly Type I collagen).[5] This dense fibrous connective tissue is devoid of vascularity and innervation which allows the TM joints to function freely without discomfort during normal function. If there is pain, it is likely due to chronic inflammation or a recent joint trauma.

Another aspect of joint physiology to consider, is that the TM joint is adaptive to slow changes, and can stabilize on its own, if enough time and space are available to enhance its' own regenerative potential.[5] The fact that most patients are able to function (masticate, swallow, etc.) despite disharmony between various components of the masticatory system, indicates that the masticatory system is adaptive, and that some types of system degeneration will fall within the adaptive range of patient's masticatory capability. However, when the adaptive range exceeds overloading limits, the patient's weakest link is the first to be affected, which could be either the teeth, bone, muscles or the joints.

Whether a patient presents with an (apparently) minimally invasive need, or a complete occlusal rehabilitation, , it is imperative to diagnose the condition of each component of the system before undertaking any significant clinical procedure. Another issue to be considered is whether a dysfunction, when present, requires any corrective measure, can be stabilized with a simple appliance, or there is further need for a more comprehensive treatment plan to resolve the symptomatology.

In the first clinical case presented (Fig. 1-5), it was determined pre-treatment, that the right TM joint exhibited a long-term chronic reducing disc displacement. Despite that, the patient exhibited a normal range of opening, a normal functioning and swallow action, and nearly normal muscle activity levels. All of the electrodiagnostic measurements (JVA, Jaw Tracking, EMG) [6-10] indicated that, although the status of the right joint was not normal, it was stable. This patient's right TM joint was well within its' adaptive functional range. This patients' dentition demonstrates wear of the upper and lower anterior teeth, which represents the weakest link in this patients masticatory system. But with the stable right disc assembly, it is safe to provide the patient with minimal anterior restorative dentistry, combined with a night time appliance to prevent further damage resulting from nocturnal parafunction. In contrast, the second patient (Fig. 6-12) had experienced severe long-term dysfunction for an extended period of time, and required extensive rehabilitation to restore the masticatory system.

Fig. 1 - Visible incisal wear on the maxillary anterior teeth
Fig. 2 - Discoloration of tooth due to consumption of well water


Fig. 1


Fig. 2

Clinical case I

This patient presented with extensive wear on the incisal surfaces of the maxillary anterior teeth with their corresponding mandibular anterior teeth showing extensive incisal and facial wear (Fig. 1). The patient's maximum intercuspation position presented with left and right side as Angle's class I canine and molar relationships. The mandibular dental midline was 2 mm to the right of the maxillary dental midline. The anterior teeth in MIP were vertically over-closed based upon a *Shimbashi measurement* of only 11mm compared to the mean normal adult value of 18 mm.

The patient's chief complaints were:

- the presence of visible wear on the incisors and canines
- teeth sensitivity to temperatures and sweets
- cosmetic concerns due to wear which affected her smile

A comprehensive examination was performed which included:

- full mouth intraoral periapical radiographs
- a panoramic radiograph
- 3 different tomographic radiographic views of the condyle when the teeth are in MIP, at rest, and at full opening
- cephalometric radiographs including a Townes view
- JVA/JT and JT/ velocity trace,
- resting and clench EMG data,
- swallowing EMG data,
- range of motion (ROM) trace, and
- maxillary and mandibular diagnostic models

Previous history

The patient had consumed well water all of her life which consequently led to discolored teeth (Fig. 2). The patient was aware of popping sound in her right TM Joint for many years. She reported no accident, headache, neck-ache or facial pain history. The patient was aware of night-time clenching.

Diagnosis based upon each diagnostic evaluation:

Full mouth radiographs and the panoramic radiograph analysis:

- upon intra oral examination, patient presented with previously restored teeth with no signs of pathology or existing decay .
- no periodontal bone loss was visible
- wisdom teeth were not present
- normal nasal septum appearance

Analysis of the bilateral tomographic radiographs of the temporomandibular joints

- left condyle to fossa relationship at MIP shows posture within normal limits
- at rest, there is normal decompression
- at full opening – there is normal to slight hyper-translation
- right condyle to fossa relationship at MIP shows posterior and superior condylar posture
- at rest, there is significant decompression
- right full opening shows hyper-translation (due to reducing disk displacement)

Analysis of the cephalometric X-Rays:

- a normal lordotic curve present
- there is good spacing between C1 and base of skull
- there is good spacing between C1 and C2
- mandibular plane is bilaterally aligned
- class III skeletal tendency only
- normal distance between mandibular plane and hyoid bone
- normal 2 dimensional appearance of oropharyngeal airway
- normal occipital protuberance

Findings from the Towne's view X-Ray:

- normal condyles with no evidence of osteoarthritic conditions present bilaterally
- neck of condyle appears normal bilaterally
- normal mandible posture visible at full opening

Diagnostic models:

- when mounted on an orthopedic articulator (Acculiner) they presented with normal upper and lower occlusal planes, with likely dental over closure

Electrodiagnostics:

- JVA - right side: chronic and stable right anterior disk displacement with reduction (Fig. 3)
- JVA - left side: WNL
- ROM - normal
- velocity profile - normal
- clench EMG – good muscle activity levels
- resting EMG - bilateral temporalis resting EMG slightly elevated
- swallow EMG – normal

Diagnosis & findings

- right TM joint: long-term stable disk displacement with reduction Left TM Joint: Normal
- normal opening and closing velocity with slow down at terminal contact point.
- normal dental occlusal planes
- normal functioning swallow
- normal resting EMG of elevator and depressor muscles
- class III skeletal tendency
- dental & skeletal vertical over-closure
- significant maxillary and mandibular anterior tooth wear
- no other existing TMD symptoms or complaints

Consultation & treatment recommendations

Patient's chief complaints were:

- excessive wearing of the anterior teeth with the desire to prevent this from worsening
- teeth sensitivity to cold & sweets
- cosmetic concerns resultant from well water discoloring the teeth

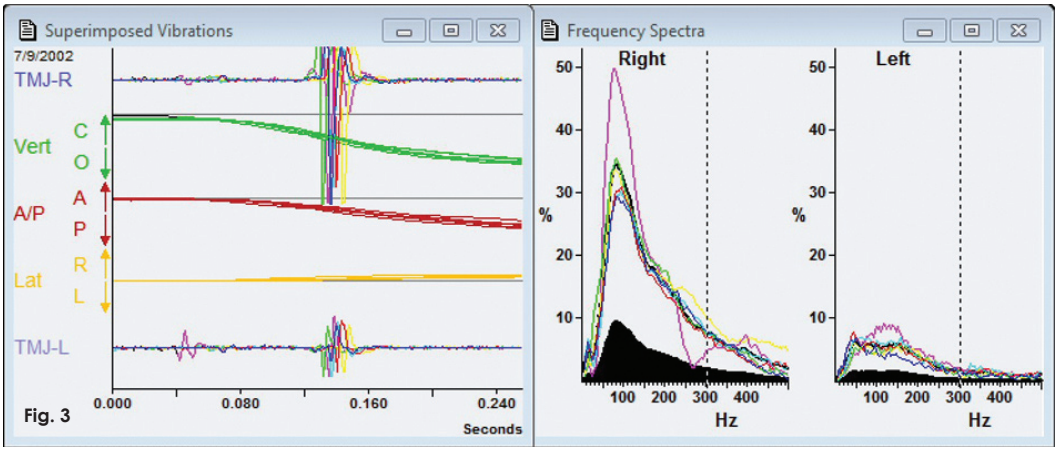


Fig. 3 - Classic right TMJ chronic disk displacement with reduction; 1) the raw waveform and 2) the discrete fourier transform DFT, showing the frequency distribution

Fig. 4 - Conservative all porcelain crowns from teeth 4-13

Fig. 5 - The night time appliance was provided to protect the restorations from wear due to the presence of nocturnal bruxism

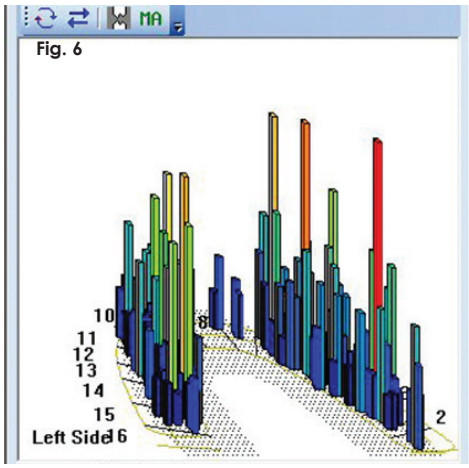
Treatment recommendations were:

- conservative all porcelain crowns from teeth 4-13 (Fig. 4)
- long-term use of night time deprogrammer to manage parafunction, and to protect cosmetic work and prevent escalation of jaw joint condition. (Fig. 5)

The proposed teeth were prepared and restored following standard cosmetic protocol and guided into the patient's existing habitual maximum intercuspation position (Fig. 4). After final restorations were placed, an objective computerised occlusal analysis was performed and occlusal adjustments were made to insure proper force finishing of the occlusion. The T-Scan III Force Plot shows a bilaterally balanced occlusion with 50.3% force on the left side and to 49.7% on the right side of the arch(Fig. 6). This high-level, precision occlusal end-result, is only possible when one incorporates objective measurement technologies of the TMJ, the muscles, and the occlusion, into the diagnosis, treatment, and the fabrication of the final restorations.

Clinical case 2

A 51 year old female was referred for treatment after struggling for many years with masticatory dysfunction and a less than attractive smile appearance. At the age of 26, the patient underwent orthodontic treatment. Subsequently she experienced excessive sensitivity and chipping of her maxillary anterior teeth, which were eventually extracted. The extracted teeth were replaced with implants that later failed. Consequently, a six-unit maxillary anterior bridge (canine to canine) was placed. It was still in place at the time of initial consultation. The patient presented with no mandibular molars on her left side, and severely worn mandibular incisors and canines bilaterally (Fig. 7). A number of abfractions were also present. For 25 years she had been treated repeatedly without achieving her goal of an attractive, comfortable and fully functional dentition. This pa-



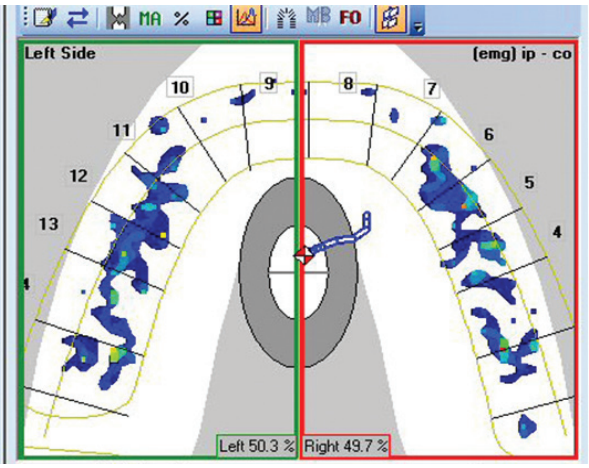


Fig. 6 - Final T-Scan III occlusal force balance of the new restorations

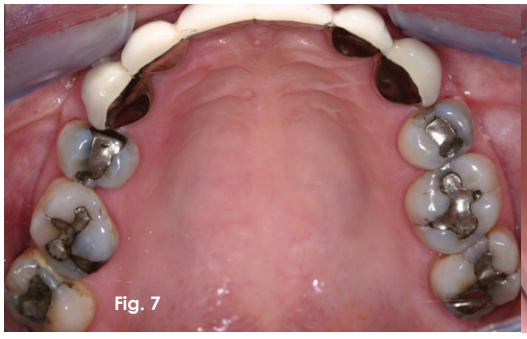


Fig. 7 - Pre-treatment intra-oral view of maxillary and mandibular arches for case 2. Note the extensive wear on the natural dentition (over 25 years), and how previous restorative work did not restore good masticatory function.

tient needed both functional and cosmetic improvements.

Patient complaints from comprehensive TMD questionnaire (prioritized)

- headaches daily (temporalis area)
- neck aches
- difficulty chewing
- ear pain right side with no infection present
- consultation with a neurologist yielded no pathology . She was prescribed pain medications
- worn anterior teeth
- cosmetically unattractive smile

Clinical examination

- pain on the right side of the maxilla
- muscle palpation- bilateral temporalis, masetter, medial pterygoid, sternocleidomastoid, splenius capitis and trapezius – all with pain
- extra oral postural asymmetry, head askew, shoulder height discrepancy and forward head posture

Additional diagnostic procedures employed for this dysfunctional patient:

- Joint Vibration Analysis of temporomandibular joint function (JVA)
- electromyographic analysis of muscle function (EMG)
- periodontal conditions charted
- examination of existing restorations
- evaluation of the existing maxillomandibular relationship
- comparison of the maxillary occlusal plane to the HIP plane
- panoramic radiograph
- bilateral tomographic radiograph
- lateral cephalometric radiograph
- diagnostic impressions, after which the upper and lower models were mounted to HIP plane

Comprehensive diagnosis

During the consultation it was explained to the patient that some of her dysfunctional symptoms may be related to her upper body poor posture. However, the JVA revealed that her left temporomandibular joint was moderately degenerated, probably due to partial collapse of the occlusion on her left side (Fig. 8). The EMG study revealed, the presence of 1) a large imbalance in both elevator and depressor muscle function, 2) a tongue-thrust swallow and 3) obvious muscle hyperactivity at rest (Fig. 9). The EMG data combined with the tomographic radiograph of the TM joints was suggestive of a distalized and/or overclosed intercuspal position. In the final analysis both conditions were revealed. Clinical evidence of some gingival inflammation and aging restorations was diagnosed upon intra-oral examination. The mounted models indicated that the patient's maxillary occlusal plane

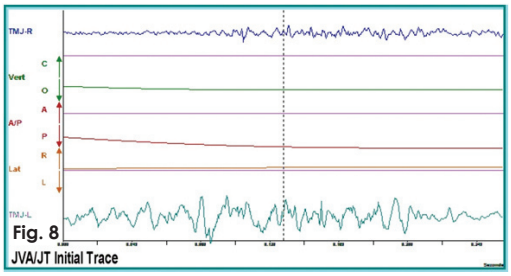


Fig. 8 - This vibration recorded bilaterally during opening is characteristic of mild (right) and moderate (left) degenerative TM joint changes. The right joint shows only a very slight roughening of the gliding surfaces, but the left joint changes are more severe

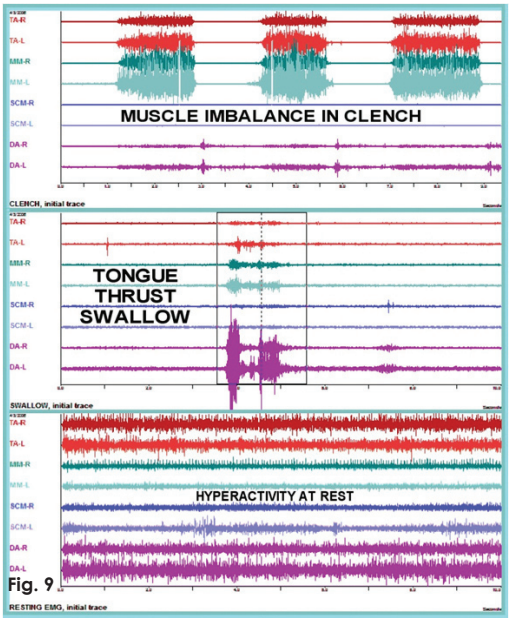


Fig. 9 - The EMG data showed an imbalance in the activity during clenching, a tongue-thrust swallow, and muscle hyperactivity at rest. These are indications of the presence of a maxillo-mandibular malrelation that coincides with a cant (roll) in this patient's maxillary occlusal plane

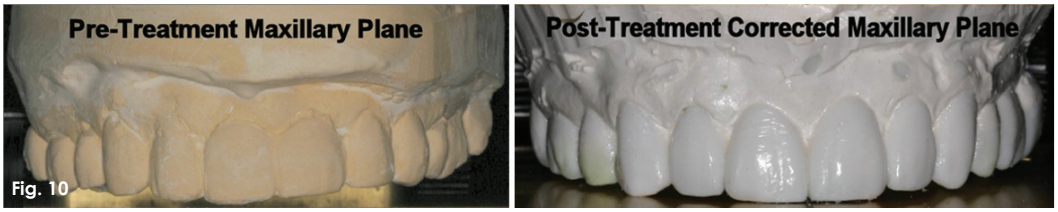


Fig. 10 - Initial cast showing severely canted (rolled up on the left) maxillary occlusal plane. A corrected horizontal maxillary plane was created which eliminated the cant and allowed normal masticatory function to occur

was canted (rolled up on the left) and that the patient's intercuspal position was poorly functional (Fig. 10). Visible evidence of parafunctional habits were present which could have lead to likely exacerbated of her overall discomfort.

Treatment plan

Phase I

1. Initial measures (routine dentistry) were taken to improve the overall health of the mouth. These included; a) removal of some old fillings that were replaced with new composite restorations, b) removing old crowns and the 6 unit anterior bridge and treating those prepared teeth with temporary crowns and bridges. This also was done to level out the existing pre-treatment occlusal plane. Existing periodontal conditions were dealt with followed by endodontic procedures and extractions where necessary.
2. Due to the presence of muscle dysfunction, a new interocclusal registration was recorded (with TENS), to increase the vertical dimension by 4 mm, followed by 2mm mandibular protrusion. New tomograms were taken to verify the new joint position. Once verified, two orthotics were ordered at this new bite registration position. A mandibular orthopedic repositioning appliance (MORA11) was fabricated for daytime wear (Fig. 11), and a second nighttime orthopedic repositioning appliance was fabricated to manage her nighttime parafunctional habits. These appliances were worn for 3 months until the patient demonstrated reduced symptoms (headaches, neck aches, ear pain, etc.) and showed maximum medical improvement (MMI).

Phase 2

Prior to a full mouth reconstruction to recreate the functional position established in phase I, the following steps were undertaken:

- A jig transfer bite was made which recreated the maxillo-mandibular relationship that the patient was functioning with, while wearing the MORA orthotic in phase I.
- The new models were then mounted on an orthopedic articulator to this interocclusal relationship.
- From this mounting, the upper arch teeth were prepped ideally, and then waxed up ideally, to level new HIP-based occlusal plane.
- The lower arch model was then prepared ideally, and waxed up to occlude with the upper arch wax-up.
- Stents were made from these wax-ups so that temporaries could be made for the full upper and lower prepped teeth that would function in the position established with the MORA appliance in Phase I.
- The remaining upper and lower teeth were prepared and final impressions made.
- Upper and lower temporaries were

Fig. 11 - Upper temporary restorations and the MORA used for 3 months during the Phase I treatment period

Fig. 12 - Final Restorations are placed

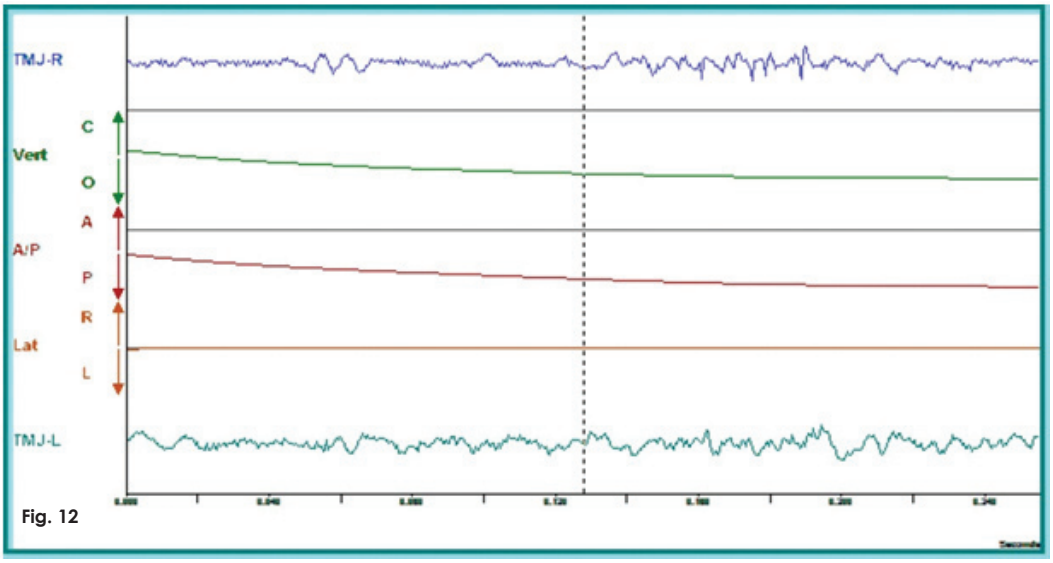


Fig. 13 - After delivering the permanent restorations a follow-up JVA was recorded. The intensity of the left side vibrations was reduce by 70% compared to the pre-treatment recording

constructed and cemented in place.

- Tomographic radiographs were taken to verify the satisfactory condyle to fossa relationships was maintained.
- Permanent restorations were prepared by the lab and delivered shortly (Fig. 12)

A new orthopedic nighttime deprogrammer was fabricated to protect the new restorations from any possible parafunctional activity. After delivery of the permanent restorations, a repeat JVA was recorded (Fig. 13). The intensity of the vibrations, especially those that were of concern initially on the left side were reduced by 70 percent, indicating improved left TM joint movement patterns. After the TMJ function and muscle function were confirmed to be improved and stable with JVA and EMG, an objective occlusal analysis was performed with the T-Scan III. This objective force balancing is critical in case finishing, but must be combined with a system that also objectively manages the TMJ and the muscles as these structures all impact the overall occlusion.

Treatment summary

The patient has maintained functional and esthetic success for the past 6 years. At the completion of treatment, she was advised to get implants and crowns installed on lower left arch to complete the occlusal reconstruction. Although the case required extensive restorations, her goals of obtaining a pleasing smile and comfortable occlusal function were successfully achieved.

Conclusions

The need for a comprehensive diagnosis in regards to the entire masticatory system prior to any type of significant restoration helps insure that the treatment plan is a correct approach to attend to the individual complaint. The decision to employ minimally invasive cosmetic dental treatment should not be made solely on the basis of desired esthetic improvements. A comprehensive diagnosis in each case helps the clinician to decide what level of minimally invasive treatment is warranted. Each case will have its' own functional and esthetic parameters, that may require a range of inva-

sive interventions. However, before deciding how much more (or little) needs to be done to properly restore a patient's dentition, a comprehensive diagnosis using Electrodignostics and computer-based diagnostic tools can prove beneficial in treatment planning protocol in present day dental practice. ■

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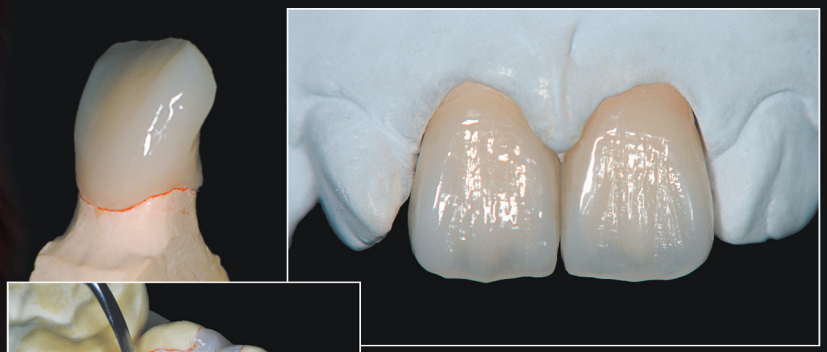

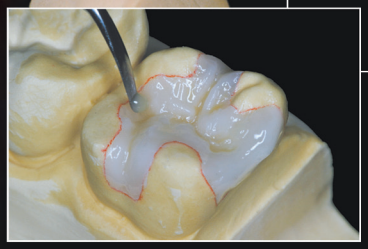

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Reproducibility of the Cervical Line of the Maxillary Front Teeth in Cosmetic Restoration

[1]Takashi Miyachi

Abstract

The visibility of the cervical line of the maxillary anterior teeth when talking or smiling varies from person to person. However, the whole cervical line is exposed in most people with a high lip line, as in the subjects in the present study. Among the many criteria for esthetic restorations, the cervical line of the upper maxillary front teeth should be given special attention. Restoration of this cervical line results in treatment outcomes with a higher degree of patient satisfaction. Here, we describe the treatment and outcome in patients with three different types of gingiva: thick (rich), thin (poor)-scalloped, and flat.

Key words: cervical line reproducibility, high lip line, porcelain laminate veneer (PLV), provisional restoration, mock-up, zirconia ceramic crown, Procera® Implant Bridge (PIB)

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Introduction

The criteria for esthetic restoration of an individual maxillary anterior tooth include size, shape, color, and surface texture of the crown, transitional line angle, and emergence profile at the margin. For a row of teeth, the criteria include tooth axes, size of the dental arch, curvature of the incisal edges, smile line (relationship between incisal line and lower lip), cervical line, incisal angle with neighboring teeth, shape of embrasure, and height of contact point. Furthermore, in addition to the color and volume of the gingiva, it is also important to consider the particular characteristics of the patient.

If the intended result is a high lip line, in which the cervical line of the maxillary front teeth is exposed, an outcome giving greater patient satisfaction may be obtained by esthetic reproduction of the cervical line and ensuring continuity of this line.

Case technique/process

The positional relationship of teeth prior to the cosmetic procedure and prosthetic outcome can vary. The gingival condition in the tooth cervical area should be carefully observed and appropriate courses of action taken before formulating a treatment plan. This article describes three cases where different prosthetic approach was used for each case taking into consideration the gingival type prior to the procedure.

Case 1: Thick (rich) - flat case

In this case, the cervical line was mostly transitional, and there was no particular need for orthodontic or plastic surgery pretreatment (Figs. 1, 2).


Fig. 1


Fig. 2

Fig. 1 - Pretreatment smile

Fig. 2 - Pretreatment intraoral photograph; frontal view

Fig. 3 - After whitening, the CR filling is repeated to ensure that restored teeth are of uniform shade


Fig. 3

The attached gingiva was firm, the gingival thickness sufficient, and there was a gentle scalloped curve. Cases such as this show little change in the continuous cervical margin position, and are highly predictable. There is thus no particular need for a subgingival restorative margin, and when selecting the repair materials, porcelain laminate veneers (PLV) or similar materials finishing with supragingival margins are indicated.

Caries treatment and whitening as preliminary measures

As a preliminary measure for fitting PLV of a shade that matches the restored tooth, caries must be eliminated and teeth should be restored with composite resin (CR). It is also possible to incorporate CR cavities into restorations, and this is an important pretreatment for ensuring uniform thickness of ceramic. Further, tooth whitening is carried out in order to achieve a lighter shade, as required by the patients. It is desirable to carry out CR restorations again to ensure that the restored teeth are of uniform shade (Fig. 3).

Final PLV

Finally, the PLV finishing line is checked on the cast to ensure it does not encroach abnormally upon the marginal gingiva (Figs. 4, 5). The pre-procedure cervical line is recreated, and esthetic restoration performed ensuring no damage to the continuity of the line (Figs. 6–8).


Fig. 4


Fig. 5

Fig. 4 - Final cast with artificial gingiva in place

Fig. 5 - Lingual view of Fig. 4

Fig. 6, 7, 8 - Intraoral photograph when PLV is fitted


Fig. 6


Fig. 7


Fig. 8

Case 2: Thin (poor) - scalloped case

In this case, the height of the cervical line was in place but the scalloped curve was steep and the gingiva was thin (Figs. 9, 10).

In such cases, progressive changes to the gingival margin, particularly localized gingival recession, can be expected. In addition, black triangles may readily form as the crown will inevitably be tapered, so that attention must be given to the subgingival area in order to ensure an esthetic outcome in terms of dental papillae. To maintain the cervical line reproduction, the concept of biologic width (1) must be constantly borne in mind. Care should be taken not to encroach into the biological width and to proactively create an esthetic form.

Diagnostic examination of the supragingival crown form through provisional restoration

First, the overall appearance of the tooth axes and the other supragingival areas was simulated using acrylic resin. At this point, connected provisional crowns are often used, and it may not be possible for the crown to be positioned directly above the root. In some cases, corrective procedures are required at this stage to move the tooth root. (Fig. 11)

The arrangement of the crowns is determined by repeated adjustment of the provisional crowns (Fig. 12). There is slight gingival recession, giving the impression that the gingiva may be weak at the cervical margin.

Fig. 9, 10 - Pre-restoration intraoral view. The patient wanted correction of the exposed tooth height of the maxillary front teeth and the black triangles between the teeth

Fig. 11 - Connected provisional crowns

Fig. 12 - Provisional crowns placed in mouth


Fig. 9


Fig. 10


Fig. 11


Fig. 12

White wax mockup of the subgingival configuration

When the positional relationship of the row of teeth for restoration and their roots is fixed, the final impression is taken and the zirconia framework is prepared in the laboratory. The crown configuration is built up on this framework using white wax, and the final configuration is produced by performing try-ins and carefully altering the configuration of the subgingival area of white wax. It is particularly important to bear in mind at this stage that there should be adequate relief from the margin to the emergence, and interdental gingival pressure should be moderate. If impeded blood flow to the interdental area persists for more than 2–3 min, the pressure needs to be reduced (Fig. 13).

As it can be difficult to maintain the correct position of several teeth within the mouth due to gingival elasticity or the presence of exudate, it is important to check the status of the interdental papilla and the embrasure on the cast (Fig. 14).

The predicted cervical line is reproduced, and the zirconia ceramic crown is fitted (Figs. 15–20).

Fig. 13 - PCast after the mock-up. Differences in the emergence from the margins that are formed can be seen in places

Fig. 14 - Mock-up cast with artificial gingiva in place

Fig. 15, 16 - Final prosthesis on cast

Fig. 17, 18 - Zirconia ceramic crown

Fig. 19 - Smile after completion of front tooth prosthesis

Fig. 20 - Final front tooth prosthesis fitted and esthetic cervical line recreated

Case 3: Flat case

This is a case in which the edentulous area had been present over a long period, and although the ridge in the deficient region had resorbed slightly and the scalloped curve was not present, prosthetic replacement was carried out with an implant (Figs. 21, 22).

In cases such as this, an esthetic cervical line cannot easily be reproduced just by adjusting the crown configuration. When a high lip line is required, the expected position of the lip line should be planned during the surgical stage of implant placement. Depending on the situation, leveling of the alveolar ridge bone may be required prior to implant placement. In the present case, four implants, including angled implants, were placed (Fig. 23), and the cervical line was recreated on the superstructure (Procera® Implant Bridge; PIB) that included a bed (Fig. 24).

Use of provisional PIB to determine superstructure

The arrangement of the crowns is examined on a provisional PIB, and through repeated adjustments, the PIB margin is positioned such that it is not exposed even with a gummy smile (Fig. 25). The final prosthesis is placed when the intended cervical line and margin have been determined, but in this case the shade of the gingiva needs to be chosen in addition to the shade of the teeth. In general, it is common to select a rather bright color (Fig. 26).

The PIB is fixed in place with screws, so that factors that negatively affect the treatment such as gingival reaction during try-in can be alleviated. It is therefore relatively easy for the practitioner to control the amount of pressure, and as a result more satisfactory simulations can be carried out prior to fitting the prosthesis.

Fig. 21 - Intraoral view after implant surgery

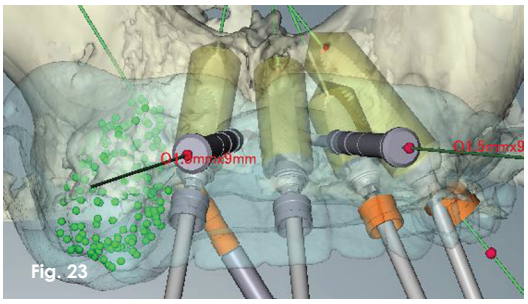
Fig. 22 - Cervical line recreated with partial denture

Fig. 23 - Implant placement simulation

Fig. 24 - PIB hybrid

Fig. 25 - Intraoral view of the provisional PIB® try-in. The 12 pale areas are where local anesthetic has been administered

Fig. 26 - Intraoral aspect of shade being taken



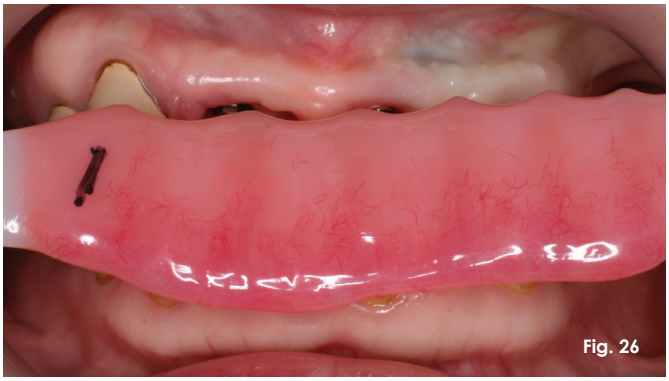


Fig. 27 - Fitting of final PIB®

Fig. 28 - Recreated cervical line when smiling

The gingival volume, the shape of the interdental papilla, and the cervical line are recreated, and the final superstructure is made (Figs. 27, 28).

Conclusion

To ensure patient satisfaction in esthetic restorations, recreating and maintaining the cervical line of the maxillary front teeth is of paramount importance. Several front teeth were restored in the cases demonstrated here, and operative procedures are rather limited in the case of a single tooth. There is more freedom for alteration of the position of the crowns in long span restorations, and at the same time, the treatment becomes more invasive.

The extent of the restoration varies according to the demands of the patient, but the practitioner should try to formulate a treatment plan that can be carried out with as little invasion as possible. ■

Disclosure

The author does not have any conflict of interest with the products mentioned in this article.

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Minimally Invasive Orthodontic Treatment

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Dentistry enters the renaissance era with the resurgence of the concept of minimally invasive dentistry. Minimally invasive dentistry is once again gaining importance and acceptance by the profession and the public in recent years. Basically health service aims to preserve the human body in its natural form and function. The practice of minimally invasive dentistry also follows the principle of 'systematic respect for the original tissues'.

The concept of minimally invasive dentistry includes early diagnosis, individual risk assessment, tissue conservation, non-surgical or minimal surgical interventions, and removing and replacing with as little tissue loss as possible. The goal is to prevent the disease from occurring and intercepting its progress. The use of a range of dental materials, instruments, radiographic exposure and surgical intervention should be instigated only when necessary.

The application of minimally invasive dentistry is also valid in Orthodontics which encompasses on prevention, interception and correction of malocclusion and irregularities of the dentofacial structures. The preventive and interceptive orthodontic procedures are in the best spirit of minimally invasive dentistry. Preservation of dental arch length with timely prevention and restoration of proximal caries, timely exfoliation of deciduous teeth, and maintenance of arch space using space maintainers can prevent the development of malocclusion to a great extent. The practice of interceptive orthodontics with the guidance of occlusion, habit breaking appliances, regaining of the lost arch space, and early occlusal corrections can intercept the developing malocclusion. Timely correction of such problems can prevent the complicated treatment regimen in future.

Objective of the orthodontic treatment should focus on removing the cause of the malocclusion rather than to correct the discrepancy mechanically. The underlying causes of malocclusion such as muscle imbalance, mandibular posture, pernicious oral habits, airway restrictions once corrected will give natural and stable results. The corrected oral functions will be followed by improved oral and facial forms as described by Tom Graber in 'form and function relationship'.

Myofunctional appliances and dentofacial orthopaedics follow the minimal intervention protocol. Functional appliances act by either harnessing the muscular forces or by preventing aberrant muscular forces thereby achieving the normal dentofacial relationship. Early correction of dentofacial abnormalities with orthopedic appliances can improve facial skeletal proportions of the growing child.

The orthodontic treatment objective should seek the achievement of normal or physiologic occlusion rather than the ideal. The idealistic aims of the orthodontic treatment popularly known as 'Jackson's Triad' and Andrew's 'Key's of occlusion' should be followed as far as possible; but the orthodontist's attempt to achieve the ideal occlusion shall not be at the cost of invasive procedures such as complex mechanotherapy, undue extractions, surgical interventions etc. The ideal occlusion is the preconceived theoretical concept that includes idealized principles and characteristics which represents central tendency. On the other hand, physiologic occlusion refers to functional occlusion that may deviate in one or more ways from ideal yet it is esthetic and is well adapted to that particular environment, and shows no pathologic manifestations or dysfunction.

The orthodontic treatment outcome should be naturomimetic which restores ethnic or racial variation as well as individual peculiarities and identification. The overzealous change in the dental arch form and facial profile should be avoided which will not be stable, natural and functional.

Any sort of unnecessary radiographic exposure should be avoided in dental practice. To minimize the radiographic exposure in orthodontics, use of cephalograms

should be limited. Cephalometric radiographs merely taken for the documentation purpose and unethical exposure of radiation for research purpose should be controlled. In many clinical instances soft tissue facial photographic analysis can substitute hard tissue cephalometric analysis. A careful examination of the profile photograph may provide valuable information on facial profile as obtained with the lateral cephalometric radiograph. In recent years, use of computerised and digital radiography replacing conventional radiography has reduced the radiographic exposure to the patients and operators. The studies claim upto 70 % reduction in x-ray exposure with digital computed radiography (CR) and direct digital radiography (ddR).

The corrective orthodontic treatment with non-extraction of teeth is regarded as minimally invasive treatment protocol. The extraction and non-extraction controversy in orthodontics has surfaced since the inception of orthodontic practice. Father of modern orthodontics Edward Angle was a great proponent of non-extraction treatment. He advocated the alignment of the dentition with full complement of teeth. The extraction of teeth is however obligatory in cases like severe crowding, maxillary protrusion, arch length-tooth material discrepancy etc for optimal results. The extraction of tooth may be minimized by the use of distalization appliances, slenderising, intercepting the case at young age, and the use of orthopaedic appliance.

The practice of orthognathic surgery to correct severe dento-skeletal discrepancies must be dealt seriously. The mortality and morbidity associated with surgical intervention may penalize the operator rather than the reward. It is always customary to perform orthognathic surgery upon patient's desire rather than on operator's enthusiasm. The operator may always choose the less severe form of surgical procedure if the treatment outcome does not vary. The orthodontic treatment with camouflage is a minimally invasive procedure as compared to orthognathic surgeries.

The minimally invasive orthodontic treatment (MIOT) should use minimal mechanotherapy, lessen treatment time, use lesser orthodontic force and tooth movement, and lessen procedural error in the realm of optimal biomechanical method. The radiographic exposure, tooth extraction, and surgical intervention should be instigated only when necessary. The minimally invasive procedure assure less exposure to nickel and other artefacts in the oral cavity and less chance of developing dental caries due to lesser treatment time. The MIOT protocol with simpler appliance systems prevent food impaction and plaque accumulation, causes lesser chance of gingival tissue impingement by the hooks or loops; thereby rendering maintenance of better oral hygiene. The use of less orthodontic force and tooth movement ensure lesser chances of root resorption and periodontal damage.

Minimally invasive orthodontic treatment relates to 'KISS principle (keep it simple, Sir)', where the archwire fabrication is simplified, rarely employ multiloop archwires, and avoids soldered hooks. The MIOT uses preadjusted bracket systems, bondable brackets and tubes, ligature hooks or ball hooks attached to the brackets, and elastics preferred over complex auxillaries for minor intra-arch and inter-arch corrections. The use of lighter, slow and sustained force is more comfortable and effective; for that reason 0.018 slot brackets are used instead of 0.022 slot, which limits heavy archwires. The simpler archwires offer fewer archwire changes, easy ligation and activation. Other orthodontic treatment modalities using minimal intervention includes removable appliances, fixed appliance with segmental approach, use of self ligating bracket, driftodontics (Alexander discipline), Invisalign etc. The management of malocclusion involving interdisciplinary approach with endodontic, restorative, periodontal and prosthodontic disciplines optimize the treatment results with minimal intervention reflecting holistic approach. The orthodontic patient should be periodically screened and managed for oral hygiene maintenance, enamel demineralization and development of dental caries.

The MIOT realizes and streamlines the orthodontic treatment, avoids unnecessary procedures, decrease treatment time, boost treatment result, improve prognosis, and moreover increase satisfaction to both patient and the doctor. This clinical practice enhances patient-centred approach rather than the technique-centred approach, resulting into better patient compliance. However, it must be noted that, minimally invasive orthodontic treatment is not the alternative for orthodontic problems that warrant complex treatment approach. It must be encouraged to practice wherever 'simplicity fulfils complexity'. ■

Modifying Tooth Discoloration using Direct Composite Resin Veneer

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Clinical history: A male patient aged 23 years presented with a severely discolored central incisor (#21). The tooth was endodontically treated 13 years ago. The discolored tooth was the only complaint of the patient and it was asymptomatic on clinical examination with slight altered on gingival contour.

Clinical challenges: To mimic the natural tooth colour, surface texture and the gingival contour of tooth no. 11 to restore the affected tooth no 21.

Treatment options:

a. Internal bleaching, non surgical gingival re- contouring and non prep direct composite restoration

b. Gingival re-contouring and direct composite resin veneer

c. Gingival re-contouring and indirect (porcelain or resin)veneer with minimal tooth preparation

d. Gingival re-contouring and indirect full crown with conventional tooth preparation

Patient's need/desire: Patient wanted immediate change of tooth colour that is similar with his tooth no 11. with as minimal financial cost as possible.

Selected treatment approach: Internal bleaching, non surgical gingival re- contouring and non prep direct composite restoration would have been the best choice for this case. However, considering the patient's time and financial constraint gingival re-contouring with non surgical technique and direct composite resin veneer with minimal tooth preparation approach was chosen.

Techniques involved: Minimal tooth preparation and preservation of enamel frame, non surgical gingival re-contouring technique , tooth isolation , tooth surface etching, bonding, tooth discoloration masking , composite layering, and finishing, surface texturing , polishing and super polishing techniques.

Restoration plan: The case was planned to restore with a tri-layered shading technique (using three groups of restorative materials – opaque, dentin and enamel during layering technique) to build tooth structure.


Fig. 1

Fig. 2

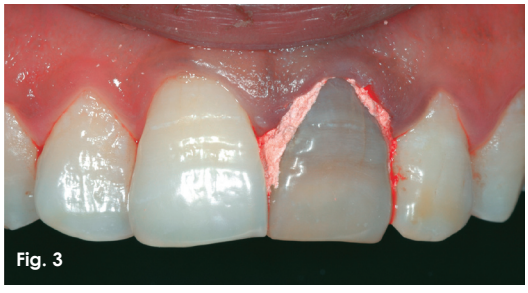
Fig. 3


Fig. 4

Fig. 1 - Discoloured non-vital tooth # 21 with asymmetry of gingival contour (shape)

Fig. 2 - Restorative Plan

Fig. 3 - Gingiva was retracted with a periodontal pack for two days to re-contour its shape without surgical approach

Fig. 4 - Note the gingival shape after removal of periodontal pack


Fig. 5

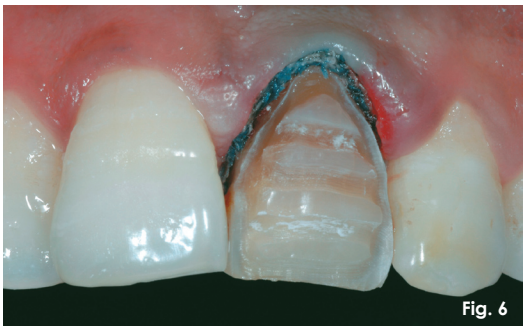
Fig. 6


Fig. 7


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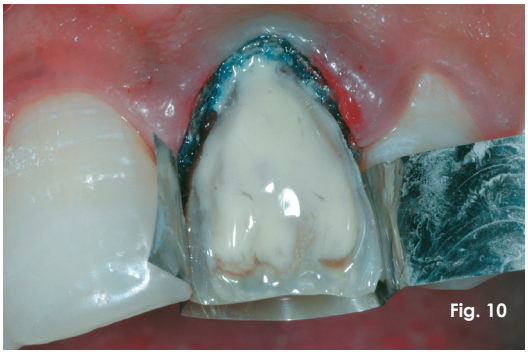
Fig. 10


Fig. 11


Fig. 12

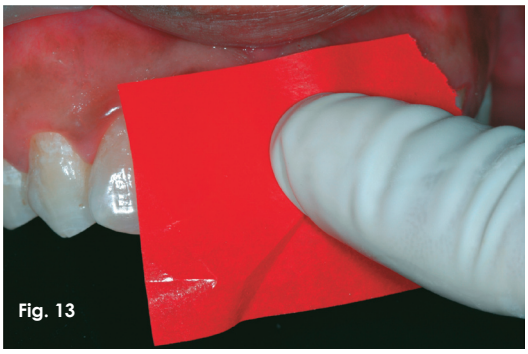
Fig. 13


Fig. 14

Fig. 5 - The tooth # 21 was carefully isolated with gingival retraction cord and marginal groove with Diamond point # 340S was prepared

Fig. 6 - Multiple depth orientation grooves were prepared with Diamond point # 121

Fig. 7 - During tooth preparation the lingual enamel frame was preserved to maintain the proper tooth contact and increase the retention of the veneer

Fig. 8 - The prepared enamel tooth surfaces were etched with phosphoric acid

Fig. 9 - The thin metal matrix was placed and bonding agent was applied

Fig. 10 - After curing the bonding layer , the discolured dentin surface was masked with universal opaque shade of flowable composite (opaque group of material)

Fig. 11 - The dentin and enamel layers were build up with increment using A2 shade of dentin group of material and INC shade of enamel group shade

Fig. 12 - Note the tooth after gross finishing before texturing

Fig. 13 - The surface texture of the restored tooth was checked using articulating paper so as to mimic the natural texture of tooth no 11

Fig. 14 - Note the prominent surface textures on tooth no 11

Fig. 15 - Creating similar surface texture on tooth # 21 with One Gloss # C1

Fig. 16 - Exactly similar surface textures were achieved as tooth no 11

Fig. 17 - The final restoration. Note the colour , gingival shape and surface textures of tooth no 21 which is exactly mimicking the tooth no 11


Fig. 15


Fig. 16


Fig. 17

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Minimally Invasive Cosmetic Dentistry (MICD) Photographic Protocol

[1]Suhit Adhikari

Abstract

Digital photography has been one of the essential tool for case documentation in cosmetic dentistry with tremendous benefits and has been efficiently used by cosmetic dentists. Minimally invasive cosmetic dentistry (MICD) treatment protocol also uses photography as an essential diagnostic tool. However, because of lack of proper photographic protocol relating to MICD concept, proper photographic case documentation is less than effective.

Aim of this article is to put forward the MICD photographic protocol based on Smile Design Wheel™ which will enable thorough case documentation according to MICD treatment protocol. This proposed photographic protocol is designed especially for MICD clinicians in order to implement MICD treatment protocol in their clinical practice.

MICD photographic views are suggested so that smile aesthetic appraisal of a patient is done from different distances (macro, mini and Micro) and with different angulations.

Key words: MICD photographic protocol, Smile Design Wheel™, macro, mini and micro aesthetics, digital photography

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Learning objectives

- To understand the concept of MICD Photographic protocol in MICD case documentation,
- To understand the different aesthetics appraisal distances (Macro, Mini and Micro) and viewing angles utilized in MICD photographic protocol to create desired views,
- To understand the basic requirement of digital camera system along with its key terms.

Introduction

Any successful Treatment protocol (TP) relies on its ability to comprehensively document and objectively diagnose the case to formulate and execute the treatment plan along with follow ups. Minimally invasive cosmetic dentistry (MICD) protocol also thrives on the same principle of comprehensive documentation in every stage (Phases) which makes it an evidence based protocol.

There are many tools and approaches for comprehensive case documentation from illumination/magnification to digital occlusal analysis. Photography is one of the important tool in MICD protocol which has been incorporated in every phase of the protocol.

Photography in dentistry has a long history which dates back to 1848 when Drs. R. Thompson and W.E.Ide of Columbus, Ohio, removed a patient'sleft superior maxillary bone, photographed the patient before and after surgery and published article with those photos in *American Journal of Dental Science* in 1850.[1] This was the first documented before and after photographs of a case.

Since then photography has been used in the field of dentistry by researcher, aca

demician and teacher for the purpose of teaching, book and journal illustrations and research. Clinician in their day to day practice started taking photographs for the purpose of documentation, medico-legal issues and communication[2, 3, 4]. Presenters were taking slide photographs for presentations. Analog camera systems used in the past lacked immediate viewing option. With the development of cheaper digital cameras, immediate viewing became a reality and as the price of digital camera system started to come into everybody's domain,popularity of digital photography as a mean of documenting, diagnosing and communicating tool in day to day clinical practice increased exponentially.

Digital photography and its importance in contemporary dentistry for the purpose of case documentation, communication with dentist-patient-dental lab technician, self-check (auditing of the treatment rendered), illustration of publications and lectures, conceptualizing efficient marketing which is integral part of cosmetic dental practice, accomplishing electronic teledentistry is also well documented.[5]

Photographic guidelines and protocols

Every diagnostic tool comes with protocol to utilize it so that it always gives standard, accurate and consistent result, irrespective of the user. However in case of dental photography no single protocol has been universally accepted because of the fact that the photography is such a robust tool that is being used in every aspect of dentistry where the requirement differs from one field of dentistry to another. The standardization of clinical photographs was first described by Ron Goodlin in1979[8] where the importance of standardization in views, magnification ratios, procedure, and lighting was discussed to enable the practitioner to compare photographic views before, after and between practitioners all over the world as the standard. Few associations, academies and universities have put forward few guidelines and protocols[9, 10, 11, 12] for digital photography in order to facilitate ease and standardize the photographic views. Many of these guidelines and protocols were related to specific field of dentistry like orthodontics[12] and those related to cosmetic dentistry[10, 11] lacked comprehensiveness. The photographic protocol used by American Academy of Cosmetic Dentistry (AACD)[10] has 12 recommended views out of which only one view is used to document the face with smile. It doesn't take into consideration on the facial profile or lateral oblique view when patient is naturally smiling or lips at rest. Similarly three views are used to document the full smile (front, right and left lateral)but it doesn't document same views with "lips at rest". This protocol mainly documents dentition only and fails to elaborate the soft tissue profile like E-plane and naso labial angle.British Academy of Cosmetic Dentistry (BACD)[11] also has the similar photographic protocol except for case type 4 (posterior quadrant) which needs 3 extra intra-oral photograph. Similarly, National orthodontics Programme, British Orthodontic Society module[12] suggested photographic views for orthodontist which surprisingly showed all the facial views (frontal,3/4th and profile) only when patient is smiling and there are no "lips at rest" views. These photographic guidelines and protocols reflect either the generalized and universal cosmetic dentistry philosophy or related to orthodontics and cannot be utilized for the MICD concept because of the following reasons:

1. Guidelines[12] and protocols are not related to cosmetic dentistry
2. Some guidelines and protocols are created for specific requirement accredited by specific organizations (e.g. AACD and BACD)
3. These guidelines and protocols do not follow the core principle of MICD philosophy which suggests appraising aesthetics in different distance (Macro, mini, Micro) and different angles (0, 45, 90,135and180 degrees) hence cannot be used for MICD case documentation.

Need for new protocol

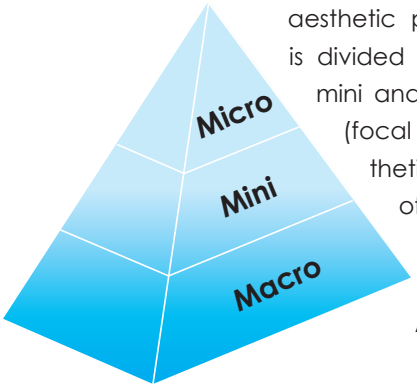
To overcome above mentioned shortcomings, MICD photographic protocol is proposed for the following reasons.

1. MICD photographic protocol is inherently based on MICD treatment protocol which suggests appraising aesthetics in different distance (macro, mini, micro) and different angles (0, 45, 90,135and180 degrees) to facial transverse plane.
2. MICD photographic protocol utilizes comprehensive photographic views.
3. It is customizable according to the practitioner's requirement.

MICD photographic protocol and its philosophy

MICD Photographic protocol is based on one of the core principle of MICD principle: Smile Design Wheel ™ [13]. Smile Design Wheel which is the major pillar of the MICD protocol consists of psychology, health, function and aesthetic as the elements of smile design pyramids. Each of these pyramids is subdivided into three related zones. Smile Design Wheel™ has a holistic approach of smile design where person's perception of the smile aesthetics, personality and desire is determined (Pyramid of psychology), where person's general, specific and dento-gingival health is properly addressed (Pyramid of health), and where person's occlusion, phonetics and comfort is restored (Pyramid of function) prior to enhancing macro mini and micro components of aesthetics (Pyramid of aesthetics)

MICD photographic protocol is based on aesthetic pyramid. Pyramid of aesthetics is divided into three major zones macro, mini and micro depending on distance (focal Length) used to visualize aesthetic components for the purpose of assessing objective aspect of aesthetics.



Aesthetic Pyramid

Appreciation of smile aesthetics from different distance (Focal length)

Appreciation of smile aesthetics can differ according to viewing distance. For example, canting of incisal plane can be seen from more than 5 feet and may be the main concern of the patient but internal cracks and spot hypocalcification cannot be visualized from 5 feet, but same cracks and hypocalcification can be readily seen with in the distance of 2 feet and therefore becomes major concern to the patient. Similarly at closer distance, dental midline may be accurate and smile may look symmetrical but from the 5 feet distance dental midline may not coincide with facial midline therefore the smile may not be symmetrical after all. Therefore, aesthetic evaluation should be done in three different distances as suggested in aesthetic pyramid of Smile Design Wheel ™ as follow.

1. Macro view (5 or more feet)
2. Mini view (2 to 5 feet)
3. Micro view (less than 2 feet)

The dental photography utilizes single 90 -105 mm macro lens to capture the macro, mini and micro views. In macro view 5 feet distance is important to avoid perspective distortion which refers to how foreground and background objects relate to one-another.The nose is closest to the camera and the ear is farther away. When the camera to subject distance is small the distance from camera to nose is much less than from camera to ear. Thus nose appears longer and whole face becomes out of the perspective which will hamper the appraisal of facial aesthetics. Of course 50mm macro lens can be used to decrease the distance between camera and the patient for macro view, but with 50mm macro lens, for micro view the distance between camera and the patient will be too close breaching the intimate space.[14]

Appreciation of smile aesthetics from different plane

It is also important to appreciate smile aesthetics from different angles to get a different and comprehensive prospective of smile. It is well documented that perfectly bilaterally symmetrical faces are theoretical concept that seldom exists in living organism[15]. Right side of the face is wider than left side with chin deviated towards left side[16]. Severt and Proffit reported frequencies of facial laterality of 5%, 36%and 74% in the upper, middle and lower thirds of the face.[17] One side of the face may be attractive than the other side depending upon personality trait most clearly expressed.[18]

One of the clinical examples could be diastema between lateral incisor and canine due to malposition which may not be evident in macro frontal view whereas same diastema may be visible in macro oblique view. Every view is documented in five angles in horizontal plane with facial transverse plane starting from clock wise.

1	left profile	0 degree to facial transverse plane
2	left oblique	45 degree to facial transverse plane
3	front	90 degree to facial transverse plane
4	right oblique	135 degree to facial transverse plane
5	right profile	180 degree to facial transverse plane

All these five angled views will enable the clinician to diagnose and formulate the smile design and treatment plan in absence of the patient as all the necessary 0 to 180 degree views are available for appraisal.

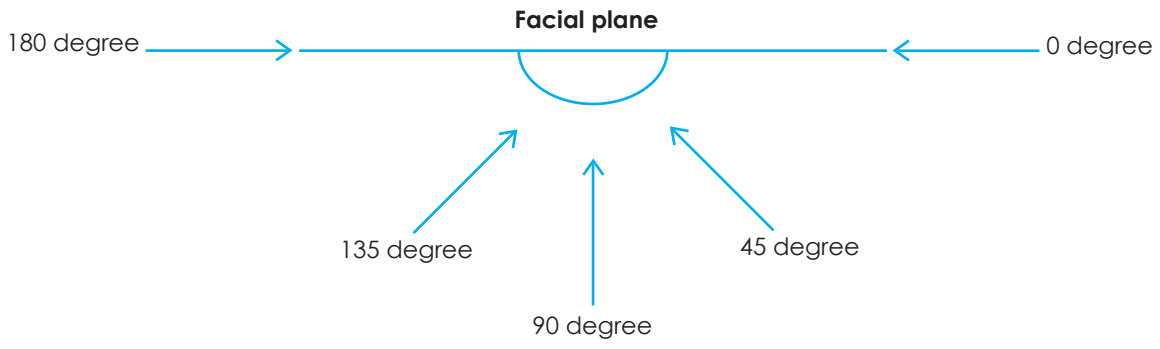
Camera system for MICD protocol

MICD photographic protocol recommends a camera system which is easy to use like point and shoot with minimum changes needed in the camera settings for different views, that gives consistently standard and correct exposure[19]. Digital single lens reflex (DSLR) body, 90 to 105 mm fixed focal length camera lens and digitally synchronizable (E-TTL) ring flash is the bare minimum requirement of the camera system to be used in MICD photographic protocol, although some manufacturers have come out with point and shoot camera specifically designed for dental purpose which can be kept as an exception. Even though some authors[20] suggest 50mm lens for portrait photography in general, to keep armamentarium to minimum level only one lens with 90 to 105 mm fixed focal length is suggested. Ring flash is necessary for proper and uniform illumination of intra oral views.

Other sterilizable photographic accessories include lip and check retractors, intra oral photographic mirrors and contraster.[21]

Magnification

In order to standardize the photographic views, it is mandatory to use some kind of fixed magnification for each view so that different photographs of same view can be compared. Many digital SLR cameras have smaller sensor size compared to normal 35 mm slide therefore usual magnification should be multiplied by certain number(crop factor).[22]



Example would be if you are using 1:1 magnification in your lens, it is actually 1:1.5. Digital SLR with sensor size of 35mm slide will not need this crop factor[23].

Depending upon type of digital camera and lens, macro, mini and micro views can be documented using the range of 1:10, 1:3 and 1:1 magnification

White balance

It is important to document colour in its true nature in cosmetic dentistry. Most of the digital cameras have in-built white balance options including automatic option. Unfortunately automatic white balance option is not adequate for precise colour capture because of oral cavity and ring flash used for photography therefore customizing white balance using custom white balance option is necessary[24, 25].

MICD photographic views

Macro view

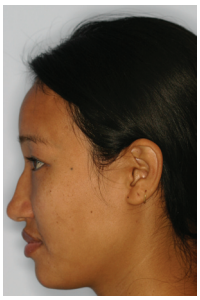
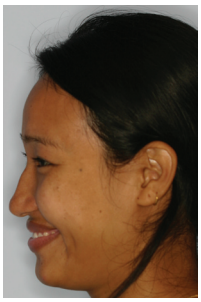
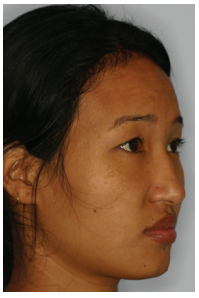
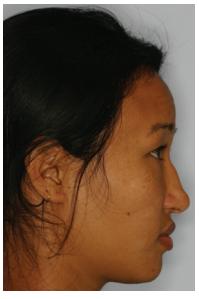
In this view smile aesthetics is evaluated in reference to overall facial structure. All views will be documented when patient's lips are at rest (M-position) and when naturally smiling (E-position). In order to make all the facial structures in proportion to each other minimum distance from camera to the subject should be at least 5 feet.While documenting in macro view face should be in natural head position, not tilting to one side as it is generally seen. These photographic views are important to evaluate facial midline, dental midline in relation to facial midline, facial thirds, inter-pupillary line, naso-labial angle, incisal plane, facial and smile symmetries and Rickett's E-plane. Most of the problems related to these views will need some specialist care such as orthodontics and maxillofacial surgery along with aesthetic treatment.

Mini view

In this view smile aesthetics is evaluated in reference to lips, chin and nose. All views will be documented when patient's lips are at rest (M-position) and when naturally smiling (E-position).The distance between sub

MICD photographic flow chart

Macro views

M- Position	E-Position
 Left profile	 Left profile
 Left oblique	 Left oblique
 Front	 Front
 Right oblique	 Right oblique
 Right profile	 Right profile

Mini views

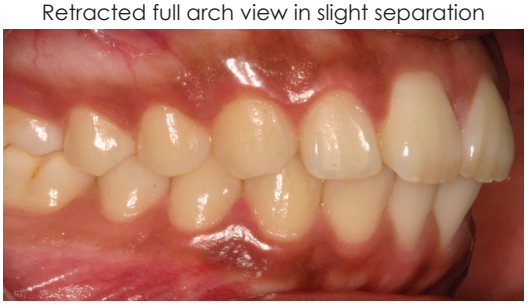
M- Position	E-Position
	
Left profile	Left profile
	
Left oblique	Left oblique
	
Front	Front
	
Right oblique	Right oblique
	
Right profile	Right profile

Micro views

Retracted full arch view in occlusion

Retracted full arch view in slight separation

Retracted left oblique view in occlusion



Retracted right oblique view in occlusion

Retracted maxillary anterior view with contraster

Retracted mandibular anterior view with contraster

Retracted right oblique maxillary anterior view with contraster

Retracted left oblique maxillary anterior view with contraster

Retracted maxillary arch with mirror view

Retracted mandibular arch with mirror view

ject and the camera should be within 2 to 5 feet. These photographic views are important to evaluate commissure height, philtrum height, upper anterior teeth visibility, smile src, smile index, buccal corridor, smile symmetry, display zone, lip line and buccal overjet. The problems related to these views might need some Orthodontic treatment along with aesthetic treatment.

Micro View

In this view smile aesthetics is evaluated in reference to dental hard (teeth) and soft tissues (gingiva). These views are taken with lips and cheek retracted and using intraoral photographic mirror. The distance between subject and the camera should be less than 2 feet. These views are important to evaluate teeth- shape, size, colour, texture, pigmentation, cracks and incisal translucency; gingival – shape, contour, embrasure, zenith height, golden proportion, central dominance, axial inclination, incisal embrasure, contact point progression, shade progression, dental occlusion, dental caries, attrition, abrasion, abfraction and erosion. Most of the problems related to these views will need aesthetic treatment. Special photograph to document colour, texture, incisal translucency will be done in this view.

Conclusion

Different photographic guidelines and protocols are available to standardize photographic documentation of the cosmetic cases, but none of them would be applicable to MICD treatment protocol. Therefore new protocol for photographic case documentation for MICD treatment protocol is suggested.

The above mentioned photographic protocol for MICD is a tool for proper diagnosis and treatment planning, as a guide during treatment procedure and follow ups, comparing before and after treatment results, medico legal issues ,publications, records and communication with different parties. The views suggested in this protocol are formulated according to aesthetic pyramid of smile design wheel i.e. macro, mini and micro. Different angles are used in order to encompass all the possible views so that case treatment planning can be done in absence of the patient. It might be necessary to incorporate more views other than suggested here depending upon the area of the work and how the practitioner wish to document provided it is within the parameters of evidence based practice and framework of the photographic protocol. ■

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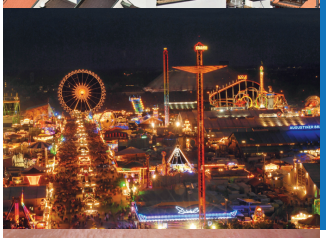

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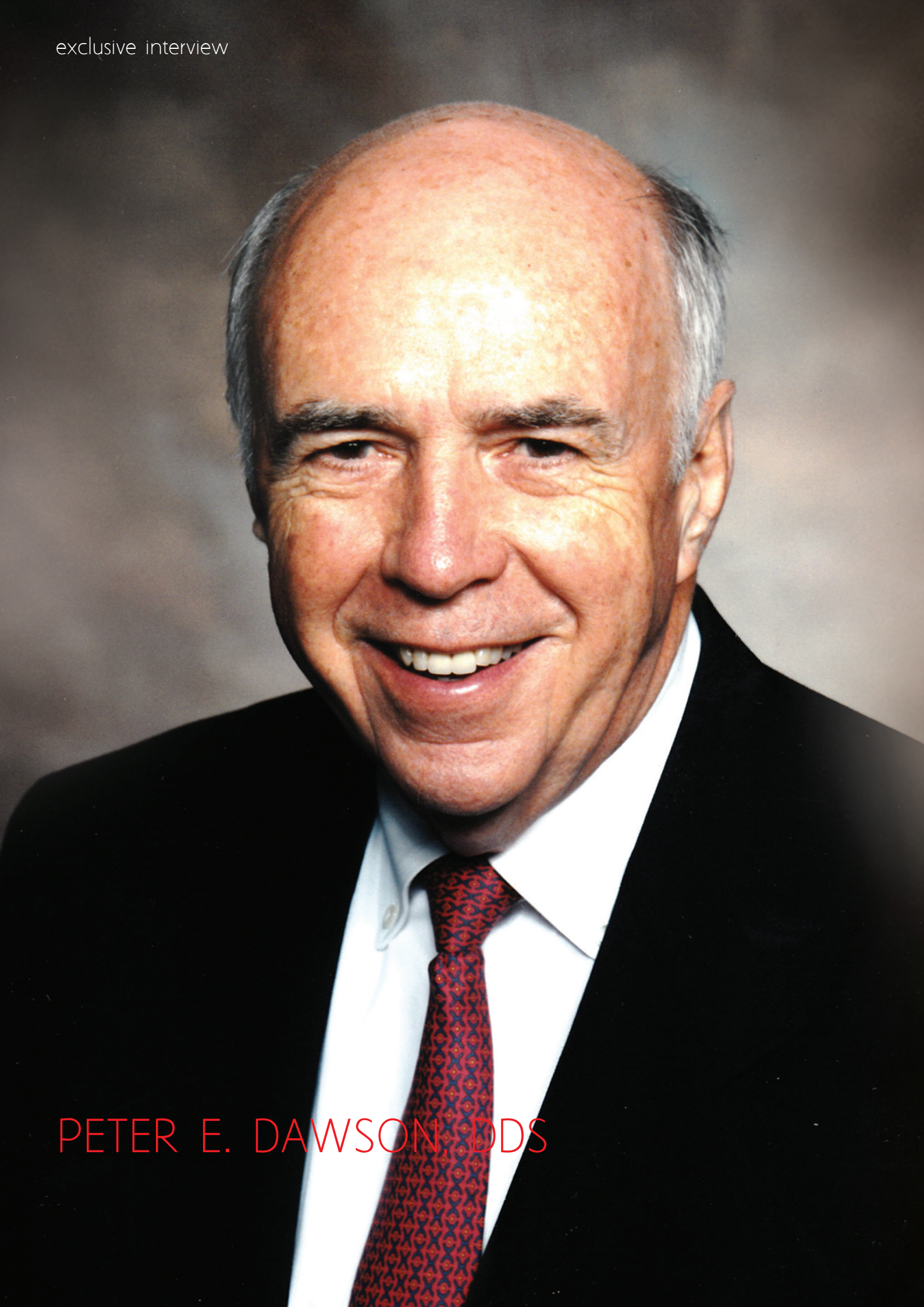


PETER E. DAWSON, DDS

COSMETIC DENTISTS NEED TO THINK IN TERMS OF TOTAL MASTICATORY SYSTEM HARMONY. FUNCTION AND STABILITY SHOULD NEVER BE COMPROMISED .....

Graduate of Emory University School of Dentistry – 1954

For more than 40 years, dentists from around the world have been traveling to St. Petersburg, Florida to attend Dr. Pete Dawson's seminars on "The Concept of Complete Dentistry". In addition, Dr. Dawson has lectured throughout the United States at almost every major dental meeting, at many Universities, and study clubs, and in many foreign countries. He is known all over the world for contributions in the field of occlusion and restorative dentistry and for his concepts on diagnosis and treatment of temporomandibular disorders. He is the author of the all-time best selling dental textbook, Evaluation, Diagnosis, and Treatment of Occlusal Problems (two editions). His textbooks have been published in 11 languages and used in dental schools around the world. His latest textbook Functional Occlusion: from TMJ to Smile Design is currently being translated into multiple languages and has been adopted into numerous dental school curricula.

- Former Professorial Lecturer – Georgetown University School of Dentistry
- Former Visiting Professor – Emory University School of Postgraduate Dentistry
- Advisory Faculty – L.D. Pankey Institute

He is the founder and director of the The Dawson Academy, a teaching center and multidisciplinary think tank in which active clinicians from all dental specialties combine their expertise in a search for better understanding of dental diagnosis and treatment.

- Fellow in the American College of Dentistry
- Fellow in the International College of Dentistry
- Past President of the American Academy of Restorative Dentistry
- Past President of the American Equilibration Society
- Past President of the American Academy of Esthetic Dentistry
- Past President of the Pinellas County Dental Society
- Past President of the Pinellas County Dental Research Clinic
- Past President of the Florida Academy of Dental Practice Administration
- Serves as a consultant to the International Journal of Periodontics and Restorative Dentistry

Honors:

- 1964 – Thomas P. Hinman Medallion award for "Leadership in Dental Progress"
- 1982 – The Achievement and Humanitarian Award for service to mankind through excellence in restorative dentistry – from New Orleans Dental Conference
- 1983 – The Thomas P. Hinman Distinguished Service Medal
- 1985 – Emory University School of Dentistry Deans Award for Special Achievement
- 1989 – Distinguished Alumni Award from Emory University
- 2004 – Lifetime Achievement Award from Florida International Dental Congress
- 2005 - Lifetime Achievement Award from American Academy of Cosmetic Dentistry
- 2006 – Gold Medal for Lifetime Contributions to Prosthetic Dentistry from the American Prosthodontic Society
- 2007 – Awarded the Thaddeus V. Weclew Award for Lifetime Achievement and conferred Honorary Fellowship in the American Academy of General Dentistry
- 2012 – Awarded the Christian Medical & Dental Associations President's Heritage Award

Dr. Dawson firmly believes that dentists must accept the role of physician of the masticatory system. For those who do, the next 20 years should be the best years in history to be a dentist. He also believes and teaches, that following Christian principles of ethical practice combined with a balanced lifestyle based on family values are the keys to a fulfilled life as a professional.
Dr. Dawson married the former Jodie Wood in 1957. They have four children and eight grandchildren. He is still active in lecturing, writing, and consulting.

The main objective of this exclusive interview section is to highlight the clinical experiences and knowledge of the world renowned clinicians & academicians obtained in the field of cosmetic dentistry. The Editor-in-Chief Dr. Sushil Koirala therefore undertakes discussions with eminent clinicians & academicians who have contributed significantly for the promotion and development of quality cosmetic & comprehensive dentistry around the world. In this issue, we are proud and honored to present an exclusive interview of ***Dr. Peter E. Dawson*** *(USA) .*

Q. *Brief history about your life , family and how you have started dentistry ?*

I grew up in a dental laboratory owned by my father, became an apprentice technician at age 13 and have been involved in dentistry ever since. Since my dental experience goes all the way back to 1943 I have seen amazing changes in the profession.

Q. *What made you attracted to work deeply in the field of occlusion?*

Because of my technician background and training, I was attracted to restorative dentistry. I realized early that there was a lot of guesswork required for occlusion – mostly a trial and error approach. I set out to learn a more predictable way to achieve a comfortable, stable bite. My studies led me to Dr. Sigurd Ramfjord who convinced me of the importance of relating the occlusion to the TMJ's. That led to an intense study of TMJ anatomy and physiology and a need to change the definition of centric relation from "most retruded" to "most superior" position in the fossae. As I started to harmonize occlusal contacts with completely seated jaw joints, I found I could get predictably successful comfort and could solve many problems of TMJ disorders, occlusal wear, and instability.

Q. *It is said that general clinicians do not want to walk on the road of occlusion. Is it because the topic occlusion is too difficult to understand and practices or it is because it has no significant role in the general practices ?*

The only reason for a dentist to ignore the importance of occlusion in general practice is a failure to understand why it is so critical to predictable success. Because of so much misinformation about the relationship of occlusion to centric relation, many dentists stay confused. Actually, the critical aspects of occlusion are not that difficult to master if the misinformation can be eliminated.

The only reason for a dentist to ignore the importance of occlusion in general practice is a failure to understand why it is so critical to predictable success.

Q. *There are various school of thoughts, concepts and groups who promote their concept of occlusion and claim that it is the most scientific one .And these type of claims help to make the general clinicians always confused in the topic of occlusion. Kindly tell us how to choose the best theory of occlusion in clinical practices and what are the fundamental clinical criterias of Healthy Occlusion.*

In my last text book "Functional Occlusion - From TMJ to Smile Design" I have outlined seven criteria (load test , clench test , grinding test , fremitus test , stability test , comfort test and esthetic test) that must be fulfilled to be able to claim "success". Rather than rewrite the chapter, I would refer you to study those criteria and the specific tests for measuring each criterion. I have subjected all my results to these tests and would challenge any dentist who claims success to do the same.

Q. *In cosmetic dentistry, majority of the clinicians restore tooth taking centric occlusion (CO) as the fundamental reference point and not the centric relation (CR) . If it is about full dentures, full mouth rehabilitation then only some clinicians start thinking about centric relation (CR) and Neuromuscular Theory. In this regards what do you suggest to the clinicians who apply centric*

occlusion or neuromuscular theory in the practices.

Cosmetic dentistry that ignores centric relation cannot pass the criteria I just mentioned. The anterior teeth are critically important to the protection of the posterior teeth. If the anterior guidance can't do its job of discluding all posterior teeth in all excursions to and from centric relation, it puts the posterior teeth in interference that activates incoordinated and hyperactive masticatory musculature. To achieve the desired goal of immediate posterior disclusions, we must have anterior contact in centric relation. We have seen too many problems from "neuromuscular theory" if centric relation is not a goal for maximum intercuspation.

Q. ***There are many cosmetic dentists who do anterior restorations (Veneers, Implant and Bridges) more frequently and think that they have not touched the posteriors teeth , so the occlusal is not of much importance . Kindly explain the role of occlusion in the anterior smile design?***

Ignoring the relationship between the anterior teeth, the posterior teeth, and the TMJs is an invitation for compromised comfort and stability. A so called "cosmetic dentist" who concentrates only on anterior teeth will not be treating patients to an acceptable standard of care.

Q. ***How to measure correct CR objectively? Kindly explain us, is CR the true physiological occlusion ? And how we can prove scientifically that patient's jaw is in correct CR and he / she is ready for restorative work?***

Again, this is an important question but a complete answer would require more than a short interview. However let me hit the high spots: We verify CR by load testing, history and other tests. Load testing uses bilateral manipulation to verify that there is no sign of tension or tenderness in either TMJ when seated with upward firm loading. If either TMJ cannot comfortably accept firm upward loading it is not in CR. The most common reason for tenderness when loaded is that the condyles are being held down the eminence by the lateral pterygoid muscle. The next most common cause of discomfort is more problematical as it relates to a structural intracapsular disorder. Verification of CR is one of the essential steps before permanent occlusal changes are initiated. Remember the position of the condylar axis determines the arc of closure of the lower teeth as they come into contact with the upper teeth. Displacement of the condyles should not be a requirement for maximum intercuspation.

Q. ***Cosmetic dentists spend most of the clinical time in finishing the case in terms of aesthetic, and forces are hardly finished in cosmetic dentistry. How do you suggest us to finish the occlusal force components in cosmetic dentistry? And what are the fundamental tools we require to achieve quality force finishing in cosmetic dentistry?***

Cosmetic dentists need to think in terms of total masticatory system harmony. Function and stability should never be compromised and they don't have to achieve the best esthetic result.

Q. ***Orthodontics is one of the most developed branches of dentistry and globally millions of patients (Children and young Adult) in a year get orthodontic treatment. However we have seen that in orthodontics, occlusion is basically governed by Andrews's six key of Occlusion Concept (Mechanical Occlusion Concept) and not by the physiological norms. Why occlusion is so much valuable in restorative dentistry and not in Orthodontics even though they change complete occlusion scheme?***

Unfortunately we see far too many orthodontic results that fail to achieve the stability of a perfected occlusion. Fortunately, there is a growing number of orthodontists who do understand centric relation and anterior guidance. There is no reason why orthodontists should not be held to the same rigid standards that restorative dentists aspire to. A major flaw in orthodontic treatment planning is subscribing to Angles classification which does not relate maximal

A major flaw in orthodontic treatment planning is subscribing to Angles classification which does not relate maximal intercuspation to any position or condition of the TMJs.

intercuspation to any position or condition of the TMJs. Diagnosing with unmounted casts is a major source for misguided treatment.

Q. *Most of the orthodontists believe that ideal occlusion is achieved by having ideal cusp to fossa relation of teeth , and spend time to bring canine and molar in class I relation after their treatment, but orthodontists hardly think about the Centric Relation in their clinical practices. How do you see this occlusion concept of orthodontists and what you suggest to them and why ?*

It really doesn't matter whether the final occlusal relationship is achieved by orthodontics, or by restoration, or by direct equilibration. If the end result requires displacement of the TMJs from CR to achieve maximum intercuspation, the posterior teeth will be put in jeopardy of excessive wear, mobility or other effects of overload. In addition, the posterior interferences that result can activate muscle responses of hyperactivity and incoordinated function. A major flaw in much of the orthodontic treatment we see is failure to have proper CR contact on the anterior teeth plus sufficient overbite to disclude the posterior teeth in excursions. Fortunately many orthodontists are recognizing the importance of both CR and a proper anterior guidance, and they are achieving greatly improved long term stability of the dentition. I'm also convinced that achieving the ideal functional harmony, results in the best, most natural esthetics for the anterior teeth.

The use of Angles classification as a guide to treatment is unreliable because it does not relate the occlusal relationship to either the position or condition of the TMJs.

Q. *Kindly mention and highlight about your Academy. In your Academy you teach about CR and manipulation technique to record it, Kindly give information to our reader that, has your academy done any Randomized Control Trial (RCT) based on your concept or philosophy?*

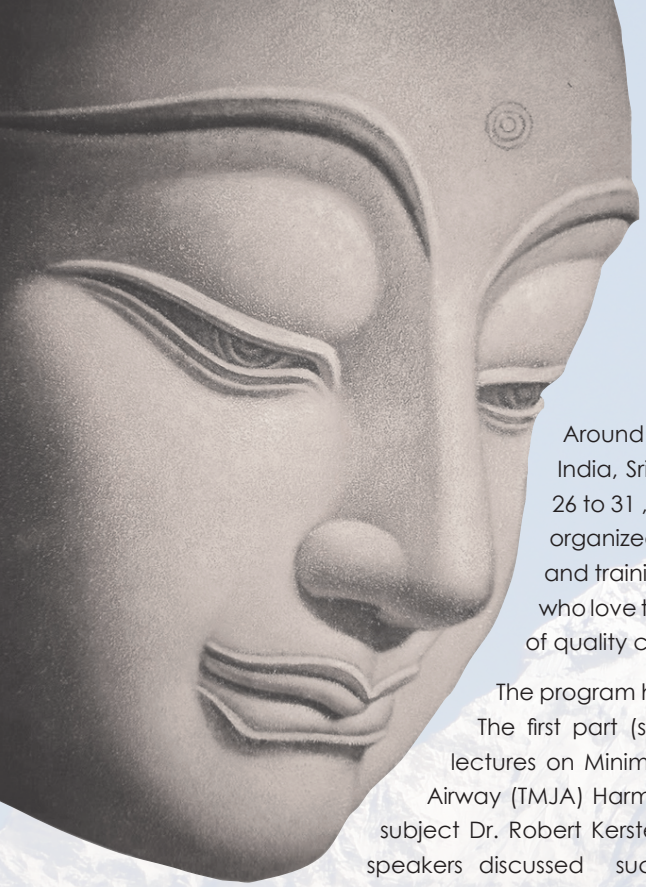
The Dawson Academy for Advanced Dental Study has served as a multidisciplinary think tank for exploring all aspects of clinical dentistry. The concepts we teach have stood the test of time as measured by the most rigid set of criteria. No one can claim a better track record for long term stability. The precise repeatability of centric relation has been taught and tested on thousands of dentists who demonstrate it to needle-point preciseness as part of their hands-on experience.

Q. *Hope you know , Asia is one of the emerging market in dentistry and huge numbers of new graduates are entering in the market every year. In this regards, is your Academy planning to expand its educational and training activities in Asia ?*

The Dawson Academy is exploring opportunities to expand its curriculum into Asia. The Japanese edition of my text "Functional Occlusion – From TMJ to Smile Design" has been exceptionally well received. In addition we are in the process of preparing our complete seminar one for online learning.■

A major flaw in much of the orthodontic treatment we see is failure to have proper CR contact on the anterior teeth plus sufficient overbite to disclude the posterior teeth in excursions.

April 13 - 14	BACD Meeting - London, UK
May 2-5	AACD 28th Annual Scientific Session - Gaylord National, Washington DC, USA.
May 17-19	SSER 9th Annual Meeting - JW Marriott, Bucharest, Romania
May 24 -26	EAED Spring Meeting: Cesme, Izmir, Turkey
9-Jun	CADE 5th Annual Meeting, Prague, Czech republic
29-Jun	BACD Meeting - Letchworth Garden City, UK
July 20-22	AAAD and JAED Joint Meeting - Sapporo, Japan
Aug. 7-10	AAED 37th Annual Meeting - Ritz-Carlton Naples, USA
Aug. 25-26	SAED meeting in Bergen, Norway
Sep. 19-22	BSAD 18th International Meeting - São Paulo, Brazil
Sep. 28-29	SCAD 4th Annual Conference - W Chicago City Center Hotel, Chicago, USA
Oct. 12-13	DGAZ 9th International Congress - Tegernsee, Germany
Nov. 3	VAED Annual Meeting - Caracas, Venezuela
Nov. 16-18	EDAD 16th International Congress - Istanbul, Turkey
Nov. 22-24	AIOP International Congress - Bologna, Italy
Nov. 22-24	BACD Annual Conference - Manchester,UK



VISA - Dental Knowledge Tourism Program

Around 30 participants from different countries like USA, Thailand, Philippines, India, Sri Lanka, Bangladesh and Nepal gathered at Kathmandu from January 26 to 31 , 2012 to participate in the first VISA – Dental Knowledge Tourism program organized by Vedic Institute of Smile Aesthetics (VISA) a global dental education and training center. Majority of the participants were busy clinicians and speakers who love travel to share knowledge and skills among professionals for the promotion of quality care in dentistry.

The program had two parts – Sharing (knowledge and skills) and enjoying (The nature). The first part (sharing) is a workshop on modern dentistry that included extensive lectures on Minimally Invasive Cosmetic Dentistry (MICD) and Teeth Muscles Joints and Airway (TMJA) Harmony concept by the world renowned speakers of the subject Dr. Robert Kerstein and Dr. Sushil Koirala . Two speakers discussed successful case diagnosis to treatment planning of various complex restorative cases using MiCD-TMJA harmony concept. They also performed the live demonstration of treatment using digital occlusal analysis (T-Scan III) and BioPAK System (EMG , Jaw Vibration Analysis and 3D Jaw Tracker) on various patients at National Dental Hospital in Nepal. The first part was organized by VISA and Big Sky Seminars (USA) in joint collaboration with TekScan and BioRESEARCH with 21 ADA CEPP credit points.

The second part - Enjoying (The Nature) was quite unique as it was exclusively planned for clinicians to escape from their chaotic and stressful professional life to some serene places of the Himalayan country. Thus, the conference was followed by three days of excursion trip to the mystical land of Himalayas, Pokhara. The trip continued to reach a magical piece of land, Pothana after trekking for almost 4 hours, and travelling further to reach on the lap of Annapurna Range of Mountains, Dhampush. The tourists could soak in the essence of eternal pure nature beauty bit by bit as the mesmerizing range of Himalayas stood smiling in front of them. Moreover, everyone thought they would melt in bliss when they got a chance to meditate in front of the most beautiful Himalayan range that Mother Nature ever created. The busy clinicians enjoyed themselves in Nepal thoroughly and couldn't refrain from understanding the facts and scope of VISA dental knowledge tourism program in promotion of quality dental care services globally through healthy and happy dental professionals.

VISA has planned to organize such programs every year exclusively for clinicians who love the sharing and enjoying concept of VISA- dental knowledge tourism program.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EVEREST

Cosmetic Dentistry in Srilanka

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SLAACD
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2002

Sri Lanka officially known as the Socialist Republic of Sri Lanka is a country off the southern cost of the Indian subcontinent in South Asia. Sri Lanka was known as Ceylon until 1972. Sri Lanka is an Island surrounded by the Indian Ocean, the Gulf of Manner, the Palk Strait and lies in the vicinity of India and Maldives. This small island of Sri Lanka is spread over an area of 25,332Sq. miles (65,610 Sq. Km) with a population of about 20.8 million.

The country is famous for the production and export of tea, coffee, gem stones, coconuts, flowers and cinnamon, the last of which is native to the country. The natural beauty of Sri Lanka has led to title the "Pearl of the Indian Ocean". The island laden with lush tropical forests, white beaches and divers landscape with rich biodiversity. The country lays claim to a long and colourful history of over three thousand years, having one of the longest documented histories in the world. Sri Lanka's rich culture can be attributed to many different communities on the island. The country is a founding member of state of South Asian Association for Regional Cooperation (SAARC) and a member of United Nations, Commonwealth of Nations, G77 and Non Aligned Movement. As of 2011 Wikipedia source, Sri Lanka was considered as one of the fastest growing economies of the world.

As most people living in any part of the world, majority of the Sri Lankans are also anxious and interested in facial aesthetics and with a pleasing and attractive smile to keep up with the standards of beauty around the world. With a high literacy rate being over 98% in Sri Lanka, the majority of the people are aspiring to get the best possible dental

treatment available to improve the appearance and their smile.

The emphasis of present day dentistry is more on cosmetics, in other words, the appearance rather than curative dentistry alone. Therefore the patients expect much more from their dentists than the past where the focus was more on curative procedures to treat caries or dental extractions. This change brought about a paradigm shift to focus towards patient aesthetic expectations and cater to their growing demands. To meet their expectations, the dentists and clinicians have to keep themselves updated with the technological advancements and acquainted with the advancements, with the latest methodologies and the latest developments in cosmetic dentistry.

Therefore it should be our endeavour to encourage all dental professionals, young and old, to keep stay aligned with the modern trends and current advances in dental technology. After all, we all greet the world with a smile. Modern dentistry will enhance the charm of this smile fulfilling their dreams to have the perfect pearly white smile that he or she always wanted. Surprisingly, such ambitious expectations of the patients can be achieved with minimal invasive restorative dental procedures, whitening treatment that brightens stained or discolored teeth use of implants to replace the lost teeth. "A smile lift", similar to a face lift, will give an individual a complete new outlook with improved self-confidence. Smile makeovers can enhance and compliment the features and outlook.

Establishment of the Sri Lankan Academy of Aesthetic and Cosmetic Dentistry in the year 2002 has provided more space for enhancing knowledge and building awareness of society, of the importance of maintaining good oral health, as the basis to acquire benefits of aesthetics and cosmetic dentistry effectively in Sri Lanka. The work of this academy has undoubtedly set a new trend in dentistry in this country. Furthermore the affiliation with the Asian Academy of Aesthetic Dentistry in the year 2002 and South Asian Academy of Aesthetic Dentistry in the year 2005 helped us progress and advance further.

We are aware that dentistry covers a whole range of treatment to ensure retention of healthy teeth in the mouth. Aesthetic and cosmetic dentistry takes dentistry one-step forward, superseding the former concept. A thorough knowledge of aesthetics and cosmetic dentistry should be disseminated to all dental surgeons globally in developed as well as developing countries. They should also receive training in the use of advanced technology to be able to help , the poor and rich alike. The importance aesthetic and cosmetic dentistry should also go to our schools appropriately to enable children to comprehend the value of minimal invasive restorative treatment. When the children develop sufficient knowledge on the usefulness of aesthetic and cosmetic dentistry, they will be in a position to drive the message home. But this method of treatment should not be misunderstood as a treatment method especially available to the affluent. The time is ripe for building awareness on the present trend emphasizing it as a treatment method available to all who deserve and mostly to those in need for it. We hope the South Asian Academy of Aesthetic Dentistry (SAAAD) will work with dedication and devotion towards this progressive objective.

The Sri Lankan Academy of Aesthetic and Cosmetic Dentistry has embarked on this journey by organizing scientific sessions from time to time to provide a forum not only to discuss the research and evidence based innovative dental techniques to keep up with the global standards of dental care but also workshops and 'hands on' courses to provide special skills in order to enhance the capacity of our dental surgeons in aesthetic and cosmetic dentistry. ■

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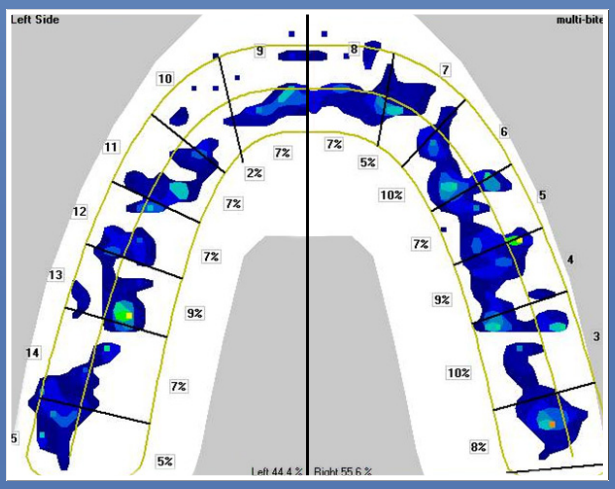

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