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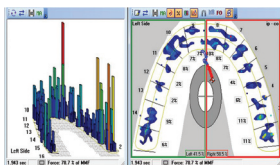
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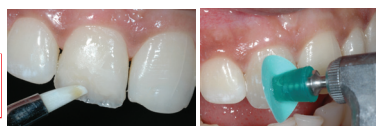
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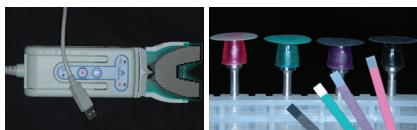
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Extension with consciousness

During early 1990's, when I was studying my basic dentistry in India, I was well trained with the basic principles of restorative dentistry, the concept of "Extension for Prevention & Retention" pronounced by Dr. G.V. Black 100 years ago. I followed this concept during my early years of practice, however, without being fully satisfied with it.

If we carefully look at the history of restorative dentistry, the word "Extension" has always been a center of focus among clinicians. With the development of porcelain fused to metal technology in late 1950's, the concept of "Extension for Functional Aesthetics" was advocated which is still very popular globally. In early 1980's, the concept of "Hollywood Smile Style" was introduced which established the concept of "Extension for Cosmetics" in dentistry. And in 2002, FDI endorsed the concept of minimal intervention (Minimal Extension) in dentistry, but this concept focused mainly on the management of carious lesions and could not address smile diseases.

Principally we all agree that the treatment modalities of all healthcare services including oral health care should be aimed at the restoration of health, function and aesthetics while conserving the healthy natural tissues. However, we have been using the concept of "Extension" in the names of prevention, retention, function, and aesthetic need and desires. Clinically we must admit that this concept will remain the center of focus even in future, since each clinical situations are different as their treatment modalities are guided by multi factorial issues like; patient factors (health, need, desires and affordability), operator factors (knowledge, skills, ethics and honesty) and technology factors (reliability, availability, affordability and simplicity). Proper use of technology requires consciousness in the operators and awareness in the patients. The three factors - patient, operator and technology guide the level of invasiveness during "Extension" in dentistry.

I personally feel that, we already have many principles, theories, concepts, protocols, materials, methods and technologies in cosmetic dentistry. However, we lack the consciousness to select these principles and technologies for better patient care. To bring consciousness in professionals is not an easy job; it requires right knowledge for a right person at the right time, so that the level of consciousness is upgraded to the higher level and the quality, ethics and honesty automatically becomes the reality in all our professional works.

MiCD clinical Journal therefore aims at providing the right knowledge to the concerned professionals to help promote healthy cosmetic dentistry around the world. The journal is initiated by VISA as a nonprofit making noble venture with the professional support and guidance of likeminded clinicians and academicians of various countries.

We are proud to present the first issue of the journal to you, and hope you would enjoy reading the clinical knowledge that we have gathered for you in the journal.

Happy New Year 2012.

PROPER USE OF
TECHNOLOGY REQUIRES
CONSCIOUSNESS AMONG
OPERATORS & AWARENESS
IN THE PATIENTS.
THE THREE FACTORS -
PATIENT, OPERATOR AND
TECHNOLOGY GUIDE THE
LEVEL OF INVASIVENESS
DURING "EXTENSION" IN
DENTISTRY.



Dr. Sushil Koirala
Editor-in-chief

The new rules of occlusion to apply during MiCD cosmetic reconstruction

¹Robert B. Kerstein

Abstract

After successfully performing a Minimally Invasive Cosmetic Dentistry reconstruction, occlusal treatment of the restoration must achieve specific occlusal force and contact timing goals, that will limit force excesses, damage, friction, and wear over the long-term. Many theoretical occlusal goals have long been advocated as dental industry standards in which force and timing quantification is clearly stated within the goals' wording. Yet, the theory can often be compromised clinically because the goals require measurement of the occlusal forces and tooth contact timing sequences to become truly achievable through treatment aimed at optimizing the measured forces and timing. In modern dental practice, the advocated theoretical occlusal goals can be predictably created case after case, by employing digital occlusal technology that can measurably detect occlusal force excess, measure time simultaneity, and calculate excursive function disclusion timing.

Key words: Theoretical occlusal goals, digital occlusal technology, measured occlusal endpoint goals, nearly equal percentage of occlusal forces, center of force trajectory, long and short disclusion time

Learning objectives

1. To understand that the longstanding advocated occlusal case finishing goals are theoretical, non-quantified, occlusal concepts
2. To learn that digital occlusal technology can measure occlusal force excess and occlusal contact timing problems that, once digitally identified, can be modified through computer-guided occlusal treatment, to measurably improve case finishing occlusal endpoints far beyond that of non-digital occlusal indicators
3. To recognize that the visual inspection of intercuspatated teeth, moving teeth during excursions, or the subjective interpretation of articulating paper marks, cannot provide the clinician with precise occlusal endpoints because these observations lack measurement
4. To understand that the new rules of oc-

clusion are defined by specific measured time values and force percentages that quantify the precision of the occlusal case finishing endpoints

Introduction

When performing an MiCD occlusal reconstruction, the judicious use of dental materials in combination with adhesion, makes it possible to rehabilitate a markedly worn occlusion conservatively.^{1,2} After the rebuilding process, to preserve the reconstruction for the long-term so that it doesn't self-damage the materials, or result in occlusally created patient discomforts (inability to chew comfortably, without pain, and effectively), occlusal treatment of the restoration at the installation must achieve specific occlusal force and contact timing goals, that will limit force excesses, damage, friction, and wear. When achieved, these occlusal goals can insure improved longevity of the reconstruction by measurably controlling the excess

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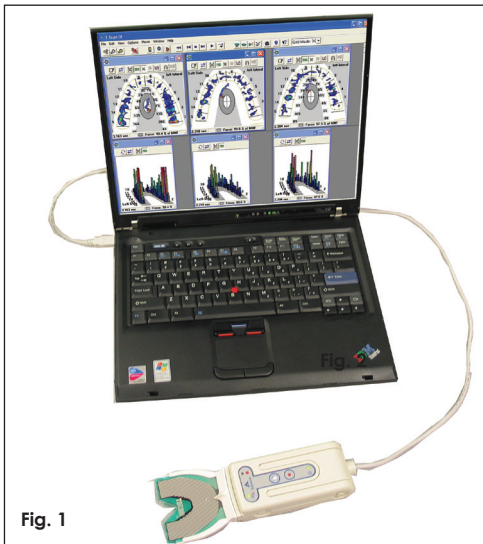


Fig. 1



Fig. 2

occlusal forces and synchronizing occlusal contact time-sequencing. By employing digital occlusal technology (T-Scan III for Windows, Tekscan Inc. S. Boston, MA USA) (Fig. 1) during case installation, measurably precise occlusal endpoints can be predictably delivered, MiCD case after case.

The longstanding occlusal endpoint goals that have been advocated within the dental literature³⁻⁶ have both force and timing components. The advocated force goals relate to the occlusal contacts that occur during a mandibular closure movement:

- There should be an equal percentage of occlusal forces shared between the right and left arch halves
- There should be an equal amount of occlusal force distributed on each individual tooth

The longstanding advocated timing goals relate to the occlusal contacts that occur both in mandibular closure movement, as well as, to the contacts that occur during

excursive function:

- In a mandibular closure movement all teeth should occlude simultaneously³⁻⁶
- The anterior teeth should *immediately disclude* the posterior teeth in excursive movements³⁻⁶, resulting in friction-free excursive movements that limit wear on teeth and activate low levels of excursive muscle function.⁷

These goals represent clinical theory only. In the absence of occlusal force and timing measurements, these goals cannot be achieved intraorally with the visual inspection of intercusated teeth (Fig. 2), the observance of moving teeth during excursions (Fig. 3), or by the subjective interpretation of articulating paper marks (Fig. 4).^{8,9,10} Because the occlusal forces cannot be “seen” by eye or in paper marks, and the timing of contact synchronization cannot be calculated visually, occlusal goal theory falls short of being clinically practiced successfully. Unless digital force and time measurement is used to determine and quantify what the

Fig. 1 - T-Scan III for Windows computer workstation with sensor and recording handle connected via a USB port
Fig. 2 - Visually well intercusated teeth does not insure time simultaneity between all occluding tooth contacts



Fig. 3



Fig. 4

Fig. 3 - Visual inspection of this excursion reveals the presence of group function. No time length of this group function is quantifiable from just observing the mandibular movement
Fig. 4 - Published studies reveal that Articulating paper marks offer the clinician no force content or time quantification of the marked occlusal contacts

human eye cannot see, the clinical practice of case-finishing with desirable high-precision endpoint occlusal schemes, cannot be predictably achieved, case-after-case.

Digital force and time measurement technology vs. non-digital occlusal indicators

The T-Scan III computerized occlusal analysis system (Fig. 1) can readily isolate excessive occlusal contact forces, which is vastly superior to the commonly utilized, non-technology based occlusal indicators which dentists routinely employ (articulating paper, wax imprints, silicone imprints, and articulated stone dental casts). None of these dental materials has any scientifically proven capability to measure occlusal forces or sequence contact timing. Additionally, they all necessitate the clinician to “subjectively interpret” their occlusal representations. The most commonly used occlusal indicator is dental articulating paper. To date, no study has shown articulating paper to be able to describe occlusal forces.^{8,9,10} Therefore, the clinicians subjective interpretation of the size and shape, and color intensity of various articulating paper markings, often leads to incorrect clinical determinations of where in the dental arches occlusal timing and force problems exist, and where occlusal treatment should be performed, or not performed. These incorrect clinical determinations occur because the clinician has been taught (incorrectly), to perceive widespread and uniform shaped markings’ appearance as representative of “simul-

taneous contact”, and “normal and balanced” occlusal forces.

In modern dental practice, the advocated theoretical occlusal goals can be predictably created case after case, by using the T-Scan III occlusal technology.^{11,12} It predictably detects where occlusal timing and force problems are present throughout the dental arches dynamically across elapsed time, in fractions of seconds (Fig. 5 a-c). This manuscript describes how digital occlusion can help the clinician to achieve high precision occlusal endpoints that will improve the occlusal outcomes of minimally invasive occlusal reconstructions. These measured occlusal endpoints require that the long-standing theoretical goals be modified into the new rules of occlusion to apply to case finishing.

Clinical case I - achieving closure occlusal force goals

MiCD smile reconstruction treatment often involves the use of partial coverage veneer restorations (Figs. 6, 7). Note in the restored view (Fig. 7), the upper and lower anterior veneers visually, all appear to be in contact at the vertical dimension of treatment. However, the T-Scan III illustrates that the right canine area is under extreme load, and is holding the case up from completely occluding throughout the rest of the mouth (Fig. 8). The total occlusal force summation (known as the center of force trajectory; COF) travels away from the midline and settles in the right canine area. There ex-

Fig. 5a – 3D column T-Scan III display of early contacts with low forces present 0.158 seconds into a closure sequence
Fig. 5b – 3D column T-Scan III display at 0.249 seconds, when posterior right forces begin to rise faster than their counterpart posterior left forces
Fig. 5c – 3D column T-Scan III display at 0.455 seconds showing last posterior tooth on right now reaches extreme force before other posterior teeth bilaterally
 Total elapsed time between figs. 5a-5c = 0.297 seconds

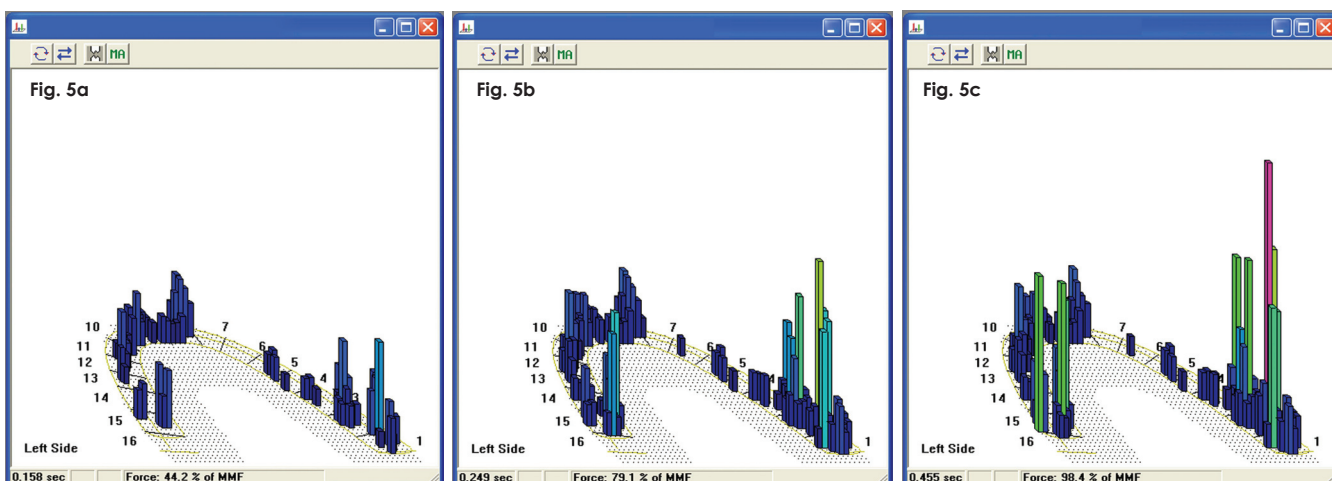




Fig. 6 - Pre operative smile before upper and lower anterior veneer restorations

Fig. 7 - Upper and lower anterior veneer restorations interscipated at vertical dimension of treatment

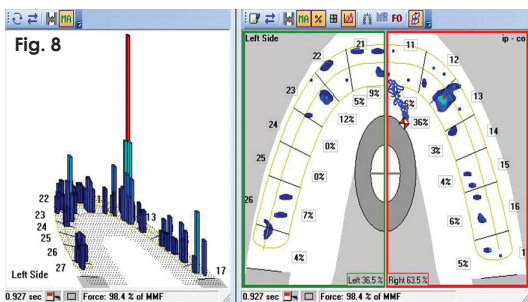


Fig. 8 - T-Scan III illustrates that the right canine area is under extreme load, and is holding the case up from completely occluding throughout the rest of the mouth

Fig. 9 - Lower anterior paper marks do not illustrate the lower right canine significant occlusal force excess

ists a right to left arch half force inequality of 63.5% right-36.5% left. This canine force excess would likely go undetected visually (because forces cannot be seen) if not isolated and displayed to the clinician by the T-Scan III's digital display. The lower anterior paper marks used at insert (Fig. 9) do not reveal the degree of force excess present in the right canine region. Over time, this occlusal force excess could become a patient comfort issue, as well as, long-term survivability issue for the veneer reconstruction.

By using sequential T-Scan III recordings that are followed by making occlusal ad-

justments based upon the force data, the occlusal forces can be aligned throughout the arches. Fig. 10 shows the mid-treatment force changes (after 4 computer-guided occlusal adjustment sequences) that have somewhat improved the overall force equality, and indicates there is more complete case intercuspation. The COF stays closer to the midline of the arches, but still settles to the right side, where the force imbalance is now lessened to 58.5% right - 41.5% left. This is mostly due to the remaining 4 high force contacts present on the right arch half. Note how the

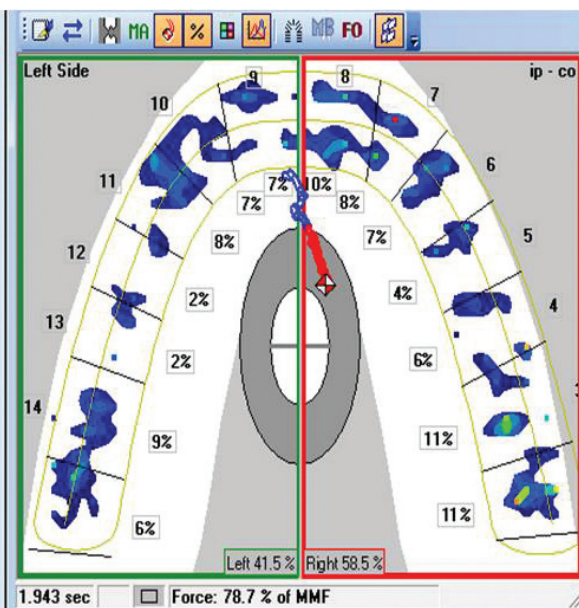
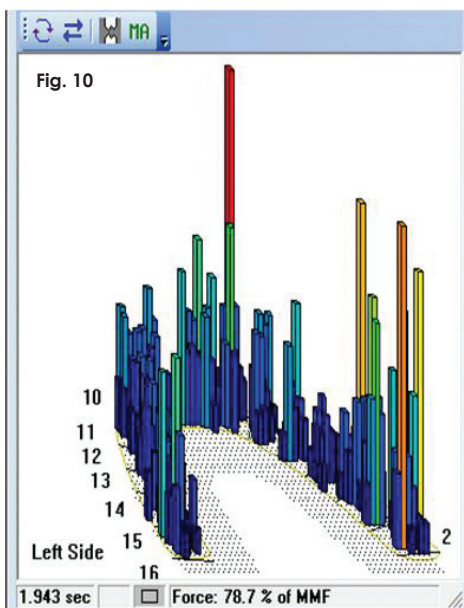
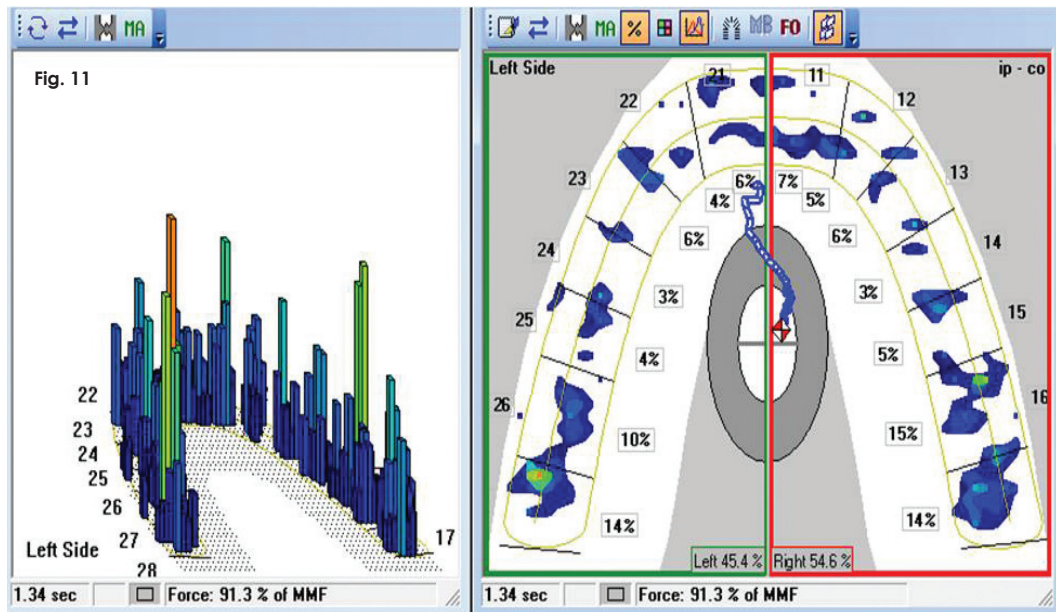


Fig. 10 - Mid-treatment force changes that have somewhat improved the overall force equality, and more complete case intercuspations, after 4 computer-guided occlusal adjustment sequences

Fig. 11 - After 4 more T-Scan guided sequential adjustments the case approaches balance at 54.5% right - 46.5% left. The COF trajectory hugs the midline through the entire closure sequence. All high force contacts visible in Figs. 7 and 8, have been lessened



T-Scan III readily isolates regions of force excess throughout the treatment course.

After further refinement with 4 more successive computer-guided adjusting sequences, the case approaches balance at 54.5% right – 46.5% left (Fig. 11). The COF trajectory is hugging the midline through the entire closure sequence, and all the high force contacts visible in Figs. 8 and 10 have been lessened down to uniform widespread moderate occlusal forces throughout the contact pattern. Note, that most of the individual tooth force percentages are fairly equal in front of the molars bilaterally, and behind the premolars bilaterally, but due to the greater molar contact surface area, individual tooth force percentage equality anteroposteriorly cannot be achieved tooth-to-tooth. This type of digital occlusal endpoint result actualizes the theoretical force goals of force equality by arch-half, and by corresponding tooth (i.e. the 2nd molars bilaterally = 14%, and many teeth in

front of the 1st molars show cross-arch force percentage equality).

This case illustration suggests that the theoretical force endpoint goal should be modified into a new rule that reflects end result force measurement:

- There should be nearly equal percentage of occlusal forces shared between the right and left arch halves within a disparity of $\leq 5\%$.¹¹
- There should be a near equal percentage of occlusal force shared between each corresponding cross-arch counterpart tooth.

Clinical case 2: Achieving closure occlusal contact timing goals

Ideal timing endpoints can also be predictably achieved with digital occlusion. Ideal timing has a numerical endpoint and a COF appearance that reflects a high degree of contact simultaneity. In mandibular closure, the more synchronized and simultaneous is the closure contact sequence, the closer the COF trajectory will originate near the midline, and remain along the midline as time elapses from first to last contact .

Fig. 12 shows the final restoration of an upper and lower veneer reconstruction. At delivery, the T-Scan III shows initial COF was



Fig. 12 - Final result of another upper and lower veneer reconstruction

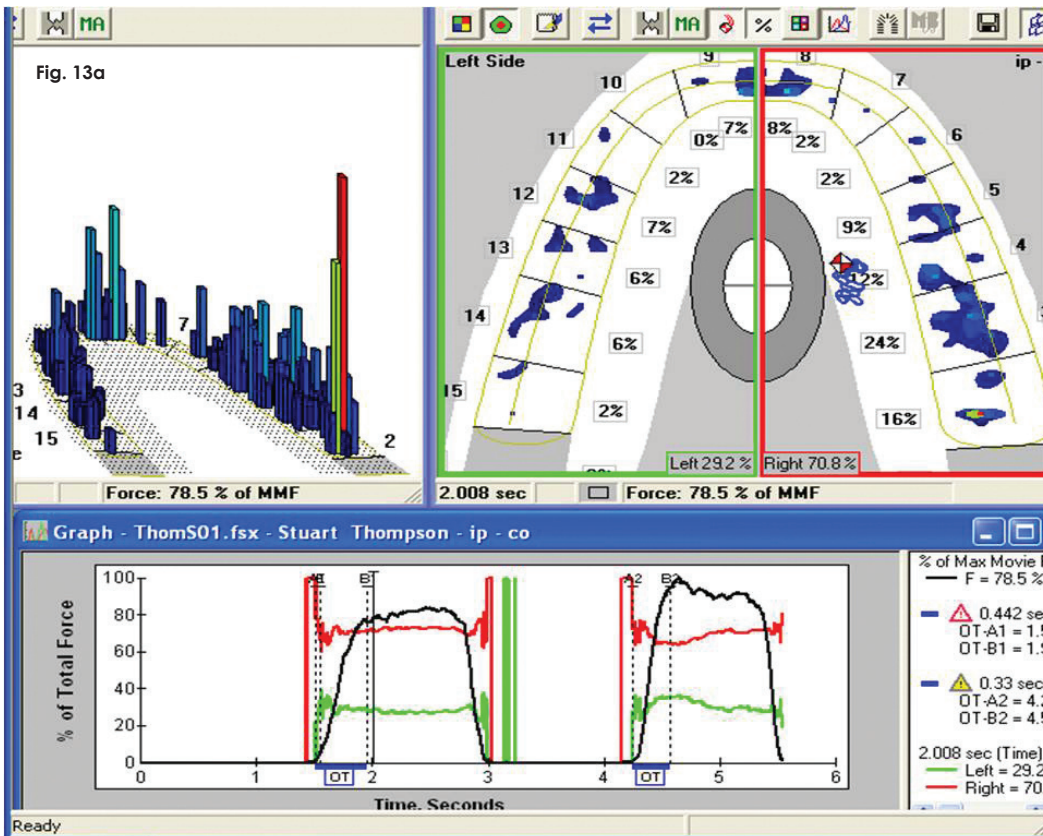


Fig. 13a - T-Scan III shows initial COF is way to the right posterior while moving from posterior to anterior over a 0.442 second time frame resulting in a 70.8% right -29.2% left force imbalance, despite the visual appearance of balance present in Fig.12

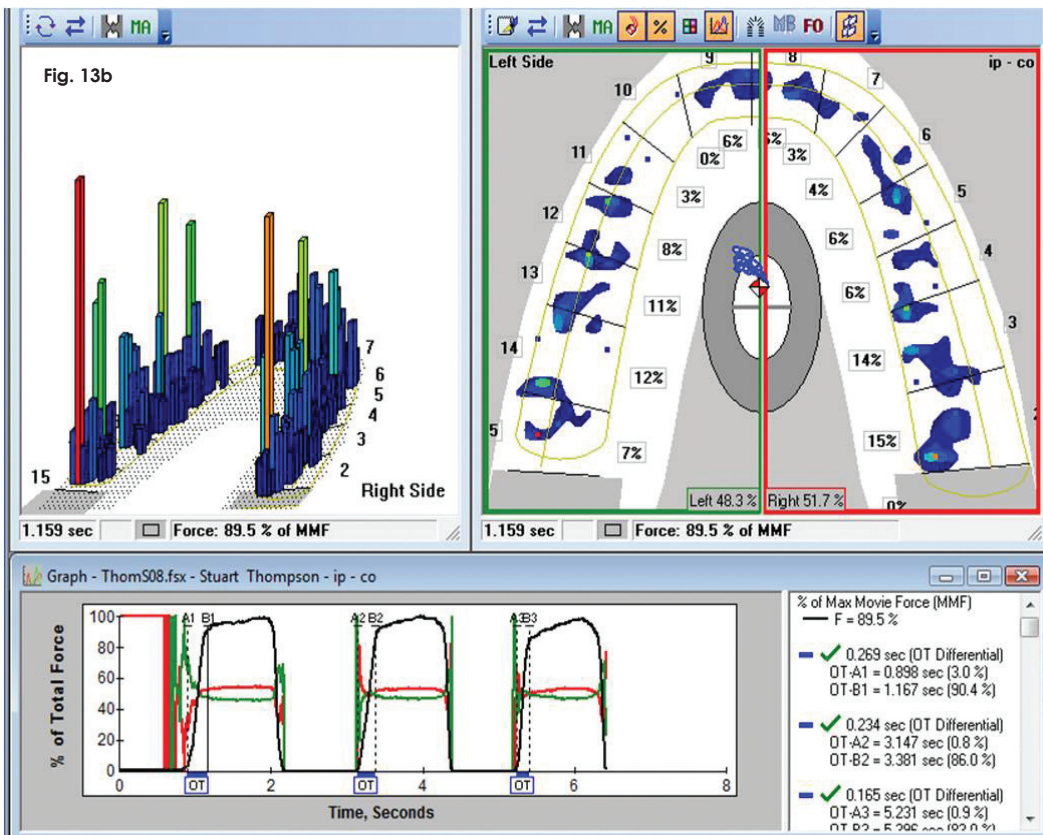


Fig. 13b - T-Scan III shows the post treatment COF moves anteroposteriorly very close to the midline, and requires only 0.269 seconds to complete the contact sequence

way to the right posterior as it moves from posterior to anterior over a 0.442 second time frame (Fig. 13a). This 0.442 second closure sequence represents a poorly synchronized occlusal contact sequence. The veneer restorations are contacting only slightly and are not supporting the posterior natural teeth, which are taking most of the occlusal force. This COF position indicates that posterior right quadrant makes occlusal contact before, and too forcefully, as compared to its' counterpart posterior left quadrant. There is a 70.8% right -29.2% left force imbalance, despite the visual appearance of balance present in Fig.12.

By employing time-sequence T-Scan III guided occlusal adjusting^{11,13}, to better synchronize the early right contacts with the later left occlusal contacts, the COF post treatment is moved very close to the middle of the arch. It starts near the midline, moves from the anterior to the posterior (instead of from posterior to anterior), is short and almost straight, and requires only 0.269 seconds to complete the contact sequence (Fig. 13b). This represents a 40% contact sequence timing improvement in the elapsed time required to pass from 1st tooth contact to last. Here again, measurement and quantification of the restored closure contact timing sequence, allowed for improved timing end results, to better approach the theoretical ideal that all teeth should contact simultaneously.

This case illustration suggests that the theoretical closure timing endpoint goal should be modified into a new rule that reflects end result Timing measurement:

- In a mandibular closure movement, all teeth should occlude in ≤ 0.2 seconds from 1st tooth contact to last.¹⁰

Fig. 14 - Visual inspection of the excursive function usually involves observing a patient as they move their mandible laterally



Clinical case 3: Achieving excursive function timing goals

If the anterior guidance function is optimal, once an excursion is commenced in any direction out of an intercuspated closure, there will be instantaneous posterior tooth disclusion. This reduces the frictional forces that are shared between teeth as they mill together during chewing, clenching, and bruxing. Less frictional force applied to the engaging teeth, reduces their potential for long-term tooth wear and restoration fracture, while simultaneously lessening any masticatory muscle hyperactivity that is often a factor in muscular overload of the temporomandibular joints.^{6,12,14,15}

Visual inspection of the excursive function usually involves observing a patient as they move their mandible laterally (all the way out to the tip of their canine tooth), to see whether the posterior teeth visually disengage (Figs. 3, 14). This visual assessment has generally been an accepted method determining the presence of immediate posterior disclusion. However, visual inspection offers the clinician no timing quantification of whether or not the disclusion is measurably immediate.

The concept of immediate posterior disclusion implies that no time elapses as the posterior teeth disengage. However, it has been shown in research studies when excursive function has been measured for time-duration, that immediate posterior disclusion does require some elapsed time to pass once the mandible moves out of intercuspatations. Posterior disclusion should occur within the first .41 seconds after excursive commencement to quickly end periodontal ligament compressions resultant from interacting opposing occlusal surfaces.¹⁴ This insures that there is low level excursive muscle function present during the excursion, while markedly negating excursive frictional contact (Fig. 15a between lines C and D).^{7,16,17} Alternatively, when the posterior teeth disclude later than 0.5 seconds after excursive commencement, prolonged periodontal ligament

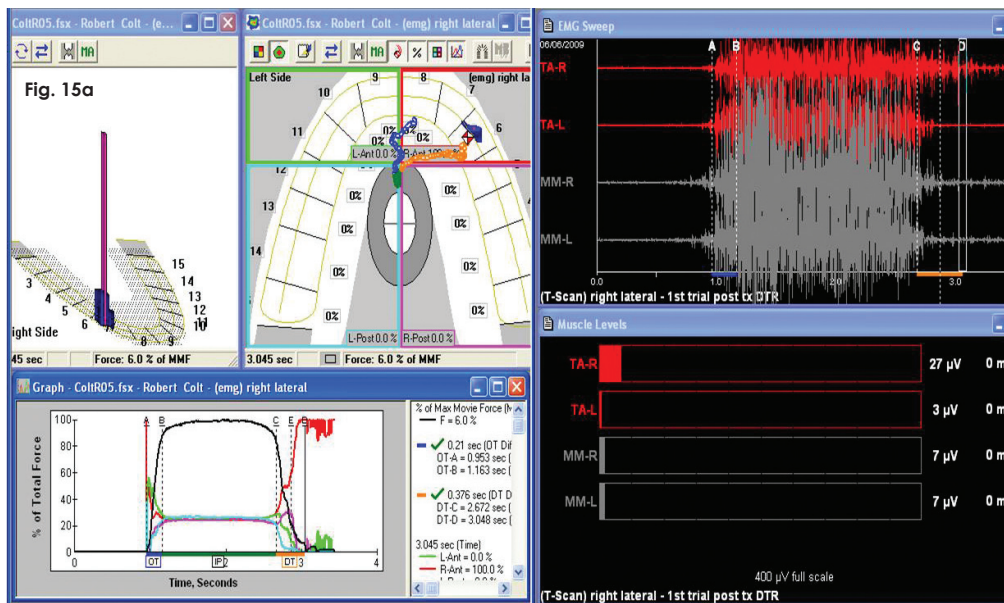


Fig. 15a - T-Scan III/ Electromyography data posterior disclusion occurs in 0.376 seconds after excursive commencement. This results in low-level excursive muscle function present during the excursion which takes place between lines C and D

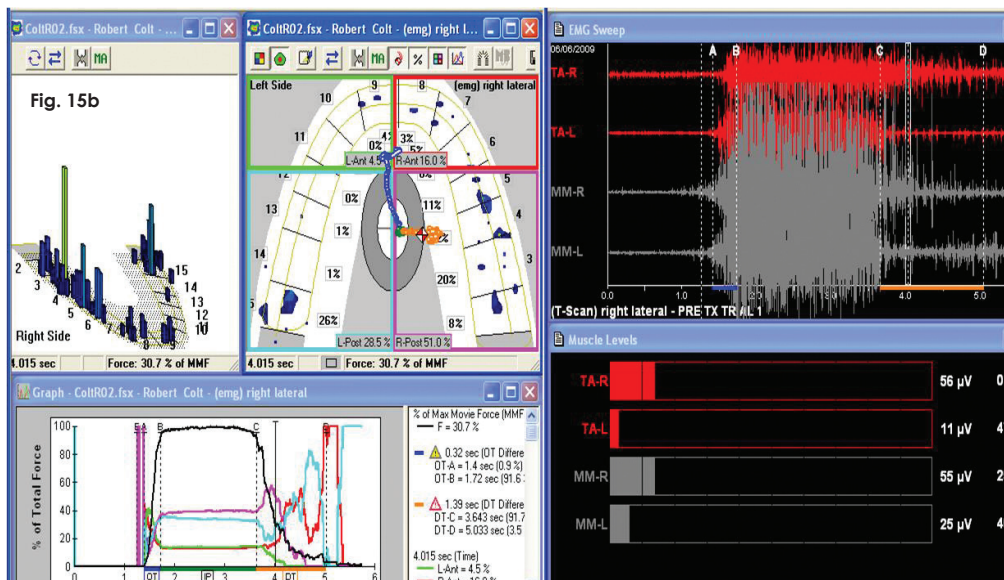


Fig. 15b - Here the posterior teeth disclude in 1.39 seconds after excursive commencement, inciting elevated levels of muscle activity between lines C and D, applying more occlusal force and increased friction to the occlusion

compressions incite elevated levels of muscle activity which overload the teeth with more force and friction (Fig. 15b between lines C and D).¹⁷

An example of this phenomenon can be seen in Figs. 16 and 17. This patient presents with worn anterior guidance and very pro-

longed disclusion. In Fig. 18, during the right working excursion the posterior disclusion lasts 0.69 seconds. To the right of line C within the electromyography data, the lack of anterior guidance results in extreme surface frictional engagement (Fig. 17), leading to extreme right temporalis hyperfunction.

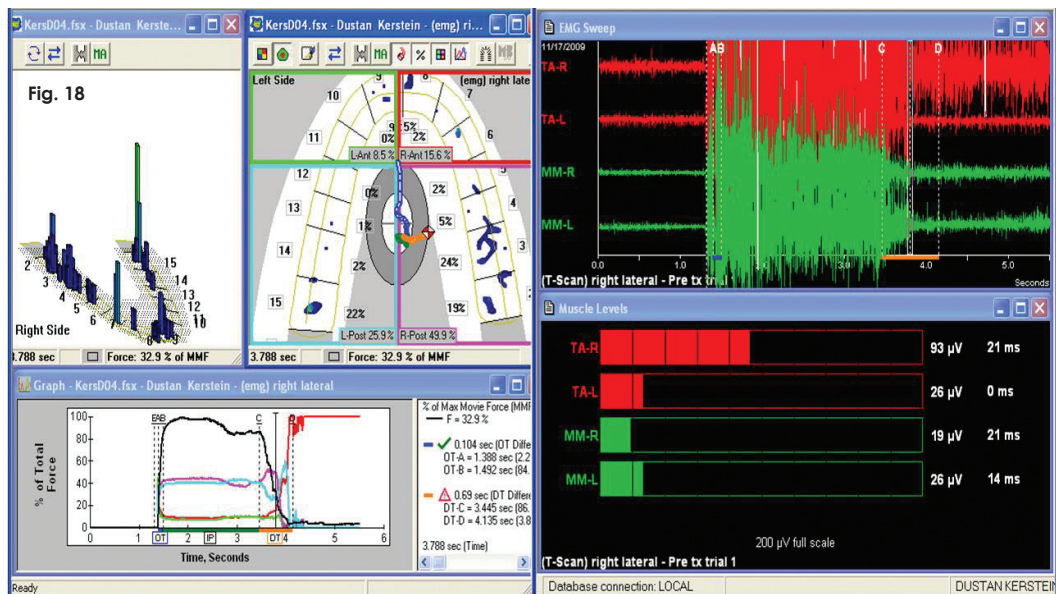
By bonding in the lost canine disclusion (Figs.

Fig. 16 -Frontal view of worn anterior guidance patient

Fig. 17 - Right excursion with no posterior disclusion due to worn canine incisal edge



Fig. 18 - T-Scan III/ Electromyography data showing prolonged disclusion of 0.69 seconds elevating right temporalis activity during the excursive prolonged disclusion (between lines C and D)



19a and b, 20), which lessened the friction and shortened the disclusion time down to .387 seconds, the elevated temporalis function is physiologically eliminated from the excursive movement. This dramatic muscle physiology improvement results from shortening the duration of the periodontal ligament compressions as the occlusal surfaces measurably immediately separate from each other (Figs. 21, 22).

This case illustration suggests that the theoretical excursive timing endpoint goal should be modified into a new rule that reflects performing disclusion time measurement:

- The anterior teeth should immediately disclude the posterior teeth in excursive movements in ≤ 0.41 seconds per excursion, resulting in friction-free excursive movements that will limit wear on teeth and activate low levels of excursive muscle function.⁷

Fig. 19a - Bonded canine riser added to tooth no. 11 incisal 1/3 being cured in contact with tooth no. 22. The same process was performed on tooth no. 6 in contact with no. 27

It is important to understand that traditional, visual anterior guidance assessments are not able to determine high precision, fractional, incremental, time-duration endpoints, that are required to affect the desired muscular therapeutic result, and the desired friction-free occlusal surface result. Only through obtaining computer-determined excursive movement disclusion Time measurements¹⁴⁻¹⁹, can the clinician know that the occlusal scheme contains a lack of immediate posterior disclusion, and whether any rendered occlusal treatment will predictably reduce excursive muscular hyperactivity.

Summary

Theoretical occlusal goals have long been advocated as dental industry standards. Force and Timing quantification is clearly stated within all the goals' wording (equal force, simultaneous contact, immediate posterior disclusion). And, yet the theory is compromised clinically because the goals require measurement to become truly achievable through treatment aimed at optimizing the measured forces and timing. In modern dental practice, the advocated



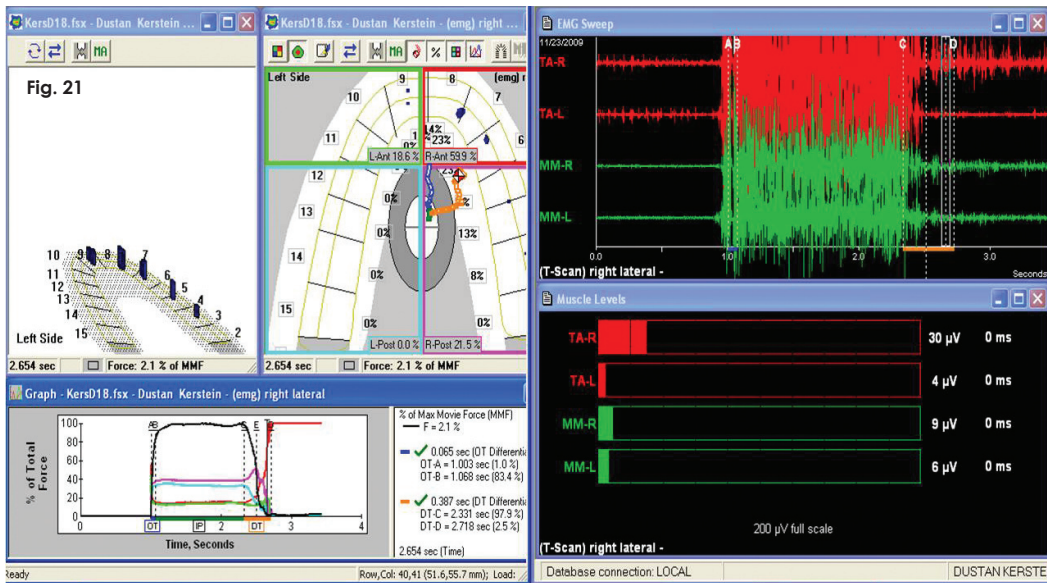


Fig. 21 - With the disclusion time shortened to 0.387 seconds due to the restored canine, the temporalis hyperfunction is removed from the excursive movement

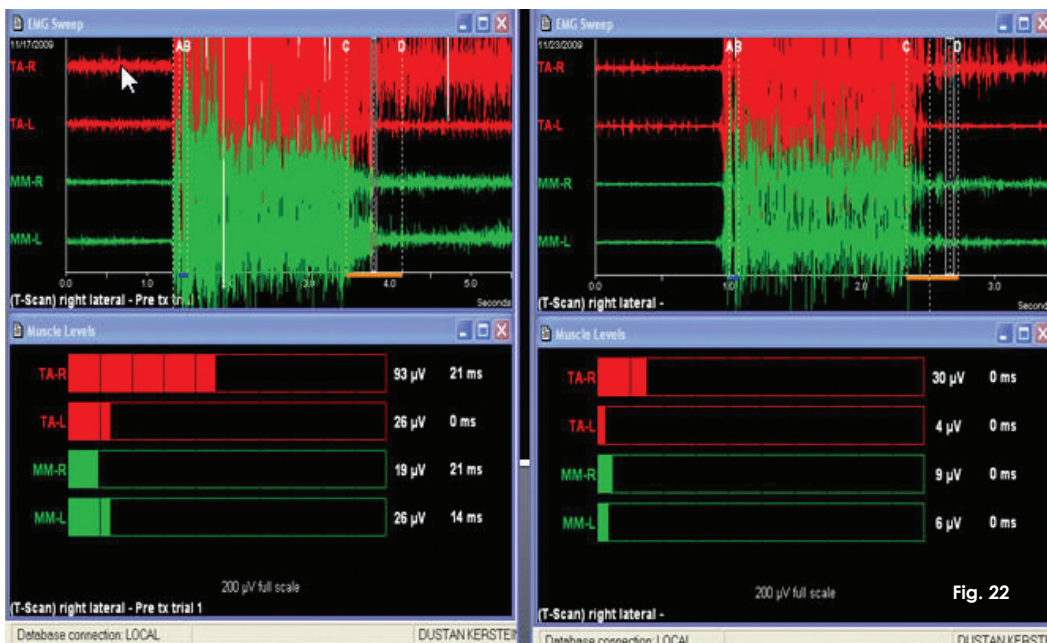


Fig. 22 - Electromyography data of the right excursion before and after the establishment of measurable immediate posterior disclusion. The right temporalis contractile activity level after treatment is dramatically reduced

theoretical occlusal goals can be predictably created case after case, by employing digital occlusal technology that can measurably detect occlusal force excess, measure time simultaneity, and calculate excursive function disclusion timing, which are all displayed for the clinician dynamically in movie-form. By employing digital occlusal technology after MiCD reconstruction, the longstanding ideal theoretical occlusal goals should be modified into a new rules that reflect occlusal force and time measurement. ■

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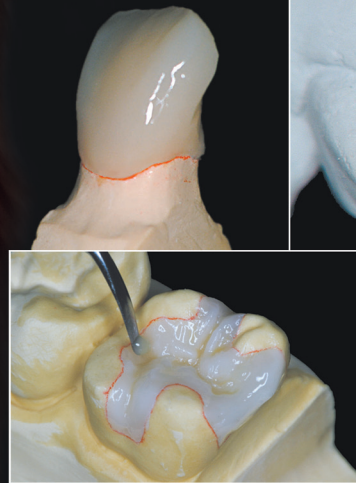
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Maximizing aesthetic success by combining orthodontics, tooth whitening and restorative dentistry

¹So Ran Kwon, ²Yiming Li

Abstract

This article illustrates a clinical case where orthodontic treatment was combined with tooth whitening and resin composites to meet the patient's desire of an aesthetic and functional improvement of her dentition with maximum preservation of healthy tooth structure.

Emphasis is given to special considerations associated with communication between the orthodontist and restorative dentist. The efficacy of different tooth whitening options including office whitening, home whitening and the use of over-the-counter whitening products is reviewed, and hypersensitivity and color regression issues associated with tooth whitening are discussed.

Key words: Tooth whitening, orthodontics, restorative treatment, interdisciplinary approach, preservation of tooth structure.

Introduction

Preservation of healthy tooth structure is one of the most important factors to consider when proposing treatment approaches to enhance a smile with aesthetic deficiencies. Frequently encountered aesthetic deficiencies in the anterior region include tooth discoloration, spacing and misalignment. Discoloration can range from a single tooth discoloration to generalized discoloration of the whole dentition. Spacing in the anterior dentition as well can be localized as seen in a midline diastema or can be distributed over the full arch causing generalized spacing. In addition to tooth misalignment, other common problems include caries, erosion, abfraction, attrition, and chipped and fractured teeth. Analysis of underlying causes will help the practitioner to formulate a treatment plan that may involve interdisciplinary approaches but should always emphasize and concentrate on the long-term tooth biomechanical behavior.

The purpose of this article is to illustrate a clinical case where orthodontic treatment was combined with tooth whitening and resin composites to achieve an aesthetic smile with minimal tooth reduction. Emphasis will be given to special considerations associated with communication between the orthodontist and restorative dentist. The efficacy of different tooth whitening options will be assessed, and hypersensitivity and color regression issues associated with tooth whitening will be discussed.

Communication between the orthodontist and restorative dentist

When dental and dento-facial aesthetics is concerned, orthodontic therapy should be an integral consideration in any treatment plan. Modifying tooth position in anterior teeth prior to the fabrication of aesthetic restorations such as composite resin bonding, porcelain laminate veneers or crowns may greatly enhance the final aesthetic and functional result (Fig 1).¹ However, as

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Fig. 1 - Intraoral view prior to orthodontic treatment. Modifying tooth position in anterior teeth prior to aesthetic restorations may greatly enhance the final aesthetic and functional result

patients commit to a more costly and more time consuming treatment it is not uncommon that there is a slight disappointment after orthodontic treatment in terms of treatment results immediately after debanding and the additional costs associated with the restorative treatment that still has to follow (Fig 3). To minimize potential disappointments it is paramount that there is sufficient communication between the orthodontist, restorative dentist and the patient during the initial treatment planning phase and during the phase imminent to debanding. Ideally the restorative dentist should evaluate whether the tooth or teeth to be restored after orthodontic treatment are in proper alignment so that unnecessary tooth reduction can be prevented. It is also prudent to go over the additional costs associated with restorative treatment prior to debanding.

Tooth whitening options and efficacy

Three whitening options are currently in use. The oldest method is an in-office procedure commonly known as “power whitening”

that uses highly concentrated hydrogen peroxide in combination with heat or light activating devices. In-office whitening has the main advantage of being totally dentist supervised with instant whitening results. However it is important to point out that usually a single visit will not be sufficient so that multiple visits are required for maximum whitening.

By far, the most commonly used option for tooth whitening offered by dentists to their patients involves the fabrication of a custom mouthguard in which a carbamide peroxide based gel is placed and worn over the teeth, usually overnight, to obtain the desired aesthetic effect. This technique is often referred to as “nightguard vital bleaching”.²

Tooth whitening is also available directly to consumers as over-the-counter (OTC) whitening products that do not require dental supervision. There are a wide variety of these OTC products, including kits that require the consumer to fabricate their own “semimolded” mouthpiece to adhesive strips or paint-



Fig. 2



Fig. 3

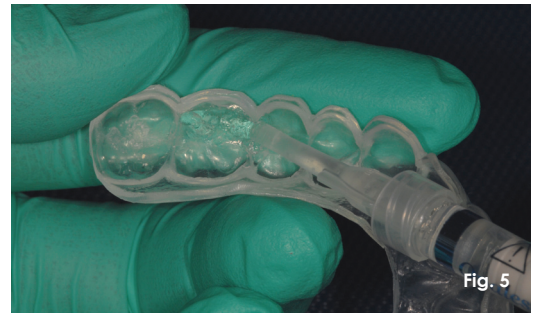
Fig. 2 - Intraoral view during orthodontic treatment
Fig. 3 - Smile after orthodontic treatment

Fig. 4 - Office whitening of the upper arch with a 40% hydrogen peroxide gel (Opalescence Boost, Ultradent Products Inc, South Jordan, Utah, USA).

Note that a linear low density polyethylene wrap was placed to prevent dehydration of the gel



Fig. 5 - Instructions on how to apply home whitening gel into the custom fabricated tray is given so that home whitening can be combined with office whitening to speed up the process



on liquids.

Research on the comparison of in-office whitening to home whitening and OTC products has focused on the efficacy, side effects and patients' acceptance of the three different techniques employed. Results vary depending on the whitening product, study design, application time and methods, and color assessment method employed. In a study by Auschill et al.³, the final outcome of interest was the number of days required for each treatment to achieve a six-tab difference on a Vita Classical shade guide: the OTC whitening technique took an average of 16 days, home whitening with the use of 10% carbamide peroxide required 7 days, whereas office whitening using 38% hydrogen peroxide required 1 day to achieve the final outcome of a six-tab difference, showing that in-office whitening provides color change more quickly. There was no difference in terms of gingival and tooth sensitiv-

ity among the three techniques.

The severity of the discoloration and the complexity of the total treatment should be considered when offering a particular whitening option to the patient.⁴ When whitening is followed by restorative treatment procedures, office whitening combined with home whitening may be the treatment of choice to speed up the whitening process (Fig 4-6)

Sensitivity associated with tooth whitening

Tooth sensitivity is a common side effect of tooth whitening. Data from various studies of 10% carbamide peroxide indicate that from 15 to 65% of the patients reported sensitivity.⁵ A higher incidence of sensitivity ranging from 67 to 78% was reported after in-office whitening with hydrogen peroxide in combination with heat.⁶ The mechanism of sensitivity after tooth whitening has not been fully established yet. Studies have shown that

Fig. 6 - Intraoral view after whitening. Once whitening is completed and the patient is pleased with the color change, a two-week waiting period should be allowed prior to initiating restorative procedure.





Fig. 7 - A two-week waiting period also ensures color stabilization for proper shade selection of the composite resin material to be used for the polychromatic layering
Fig. 8 - A lingual matrix facilitates the placement of the initial lingual layer
Fig. 9 - Polychromatic layering with composite resin (Estelite Sigma Quick, Tokuyama Dental Corp., Tokyo, Japan) to mimic the natural tooth

tient is pleased with the color change, a two-week waiting period should be allowed prior to initiating restorative procedures (Fig 7-9). There can be as much as a 25% reduction in bond strengths if the composite is applied immediately after whitening.⁸ This reduction can result from whitening agents that cause oxygen to penetrate and concentrate on the surface of the enamel, thus inhibiting the proper cure of some resin tags.⁹ Another important consideration is color stabilization after whitening, which usually takes two weeks. However when longer whitening times or higher concentrations of peroxide are involved, up to six weeks should be reserved for color stabilization.¹⁰

hydrogen peroxide, whether applied directly or derived from carbamide peroxide, readily penetrates the tooth and enters the pulp chamber.⁷ This may cause sensitivity in the form of reversible pulpitis. There are two main approaches to controlling whitening sensitivity. The passive treatment involves reducing the wear time, reducing the concentration of whitening gel, or increasing the time interval between whitening treatments. The active treatment includes a number of agents that can provide relief from sensitivity associated with whitening. Desensitizing agents include sodium fluoride, potassium nitrate and amorphous calcium phosphate (ACP) that can be applied in the whitening tray and worn for 10-30 minutes.

Proper timing of restorative treatment after tooth whitening

Once whitening is completed and the pa-

Longevity of whitening results

According to the ADA guidelines, a perceptible color change should be maintained at 6 months as compared to the control to reflect duration of efficacy.¹¹ Color regression after tooth whitening has been reported in the literature. Rosenstiel et al.¹² in a double blind study on 20 young adults showed that after a single in-office whitening procedure most of the color change evaluated with a colorimeter was reversed after one month. However, Leonard¹³ reported that at seven



Fig. 10 - Smile after whitening and restorative treatment on the upper lateral incisors. Patients have to be aware of the possible need for regular touch-ups in order to prevent any color mismatch of the remaining natural teeth and the restorations placed

years the color of some teeth remained stable and some color changes may be permanent. Generally the whitening result should last for 1 to 3 years with gradual darkening occurring after that period⁸. There is still a lack of knowledge on the mechanism of color regression. Researchers and clinicians do not know why some patients teeth remain stable in tooth color over extended periods, while others regress.¹ The issue of color regression is especially important when combining whitening with other restorative treatments. Patients have to be aware of the possible need for regular touch-ups in order to prevent any color mismatch of the remaining natural teeth and the restorations placed (Fig 10).

Conclusion

Combining orthodontic treatment with whitening and restorative procedures offers the clinician a conservative approach to solve many aesthetic challenges. Patients with the desire of an aesthetic and functional improvement of their dentition will benefit from this multidisciplinary approach. ■

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Disclosure

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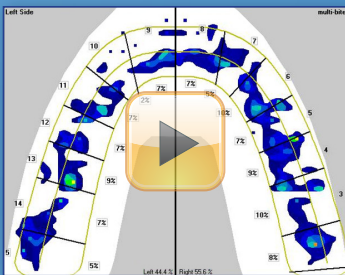
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Repair and maintenance of aesthetic restorations



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In recent years, direct resin composite restoration has shown marked improvement in its performance. However, when considering its effects within the oral region over an extended period of time, there exist some safety concerns.

As the restoration continues to function, various changes appear. Some of the malfunctions of restorations include failure of marginal adaptation, secondary caries, wear, fractures and cracks, discoloration, and missing. There are 3 ways to treat these conditions using resin composite, namely refinishing, repair and replacement. At present, there are no criteria for the re-treatment of existing restorations. It is left to the dentist and the patient to decide.

The policy statement by the FDI in 2002, "Minimal Intervention in the Management of Dental Caries" includes a clause on "Repair of defective restorations." It states that the "removal of restorations results in an inevitable increase in cavity size as a consequence of removal of sound tooth structure. Depending on the clinical judgment of the dentist, repair could be considered as an alternative to replacement in some circumstances." This means that with the advancements seen in the quality of adhesive materials, there is no need to remove the whole restoration when there is a defect. It is possible to only remove the defective area and restore with resin composite. Compared to replacement, repair is simple with minimum intervention to the sound tooth. It extends the lifespan of the tooth and pulp while decreasing the time and financial burden on the patient. The procedures of repair are as follows: First, the superficial affected parts are removed revealing the fresh surface. Next, the surface of the resin and the adjacent tooth structure are cleansed with phosphoric acid etchant. Then silane-coupling agent (ceramic primer) is applied. This is followed by the application of the bonding agent and finally, new resin composite is filled. When the cavity is small, the use of flowable resin composite is recom-

mended. This particular method of minimal restoration with resin composite is called "patched restoration".

The following are the different procedures to be taken in resin composite restoration:

Failure of marginal adaptation

The types of failure are marginal fracture, overhanging fillings, and air bubbles. In the case of marginal fractures, there is little necessity to immediately conduct restoration. However, since this may be a sign of future secondary caries or body fractures, observation should be continued. Marginal staining in overhanging fillings is problematic from an aesthetic viewpoint. However, this can be easily overcome with refinishing. Staining also occurs in the air bubbles on the cervical margin of the cavity. In this case, repair is chosen.

Secondary caries

Secondary caries occur on the borderline between the tooth structure and restoration. Those appearing on the margins are called marginal secondary caries, while those caused by leftover caries from restorations are called recurrent caries. Since resin composite restorations are adhesive restorations, marginal secondary caries caused by microleakage is considered a rare case. However there are actual cases in which, faulty bonding or micro fractures along the restoration and tooth structure of the margins bring about microleakage leading to secondary caries. Immediate care would be necessary because secondary caries directly induces pulp disorders. If the caries is limited to only the marginal area, the caries is removed and repair is conducted. When the caries is spread to a wide area, it would be safer to remove the resin composite completely and then re-restored.

Wear

Clinical problems that arise from the wear of restorations are, degradation of marginal adaptation, loss of oc-

clusal contact, loss of anatomical form which lowers the aesthetic quality. However, clinical data over the years have shown that the wear of resin composite hardly becomes a problem clinically. Thus, there are not many cases where the wear of resin composite becomes the reason for a re-treatment. If treatment is necessary, patched restoration would be sufficient.

Fractures and cracks in the restoration

The causes of fractures in restorations are degradation of mechanical properties, mistakes in diagnosis, and excessive force in occlusion. If repair seems possible, the cavity is deepened and resin composite is filled to the fractured parts. For parts that receive excessive occlusal force, other restorative methods need to be considered.

Discoloration

In resin composite restoration which is an aesthetic treatment, the color stability is always an extremely important factor. The causes of discoloration are marginal staining, interfacial staining of the resin, body- discoloration of the resin, and color mismatch by the discoloration of tooth. With chemical cured composite resin, the com-

ponent of the catalyst changes color hence changing causing discoloration several years after the treatment. However, since the introduction of light cured resin composite, the color stability has improved markedly. Marginal discoloration is caused by detectable margin so the above mentioned procedure is necessary. As for the interfacial staining of the resin, if re-polishing is not effective, repair is conducted. For the body- discoloration of the resin and color mismatch by the discoloration of tooth, repair or replacement is considered.

The missing of restorations: When resin composite which is an adhesive restoration falls off, the causes are faulty bonding in the initial treatment and the elimination of adhesion by secondary caries. In both cases replacement becomes necessary.

Postoperative sensitivity/pain

The causes for pulp stimulation by resin are chemical stimulus from resin components, stimulus from acid treatment, and bacterial stimulus from marginal leakage. Among these, bacteria is now considered as having the strongest effect. Thus, in conducting restoration, it is favorable to preserve the pulp by selecting a good bonding system that assures marginal sealing. ■



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Repair or replacement of dental restoration is a regular dilemma faced by dentists in every day of their practice. About 50 - 70 % of the restorative work done by a general dentist is the replacement or repair of restorations. Failure of dental restorations is a very common occurrence in dental practice from multifactorial cause. If a dentist has not seen his/her restoration fail means the dentist is a novice or peripatetic or in denial.

The reasons of failure of restorations (needing repair and replacement) in aesthetic zones are recurrent carious lesions, debonding, bulk fractures, loss of entire restoration, discoloration at the margins, discoloration of entire restoration and abrasion.

Repair of restorations

Early diagnosis of failing restoration helps in minimizing the damage to the natural structures of dentition and

minimally invasive repair process. Whether to repair or replace the restoration can be a subjective decision of individual dentists, their understanding of the physical, chemical and optical properties of the material used, availability of restorative material, experience of the operator, type of defect, patients affordability and acceptability, physical location of the defect, inappropriate occlusal load and etc. However, there is no randomized clinical trial for this particular question.

Resin based composite material are being used more frequently to restore dental carious lesions and defects, both in the load bearing area and aesthetic zones. The superficial extrinsic stains at the margins of restorations and localized marginal defects can be polished off by fine diamond burs in esthetic zones without disturbing the natural structures. If the restorations need repair, air abrasion technique with silica coating with appropriate

beveling, increase the available surface area for micro-mechanical bonding. At times, when repairing or correcting color of an existing restoration, using minimally invasive dental techniques, the same material previously used may not be available. The understanding of the optical properties of the previous and new restorative material helps in achieving better results. The use of low viscosity flowable resin can minimize the microleakage of the rebonded composite resin. Newer generation bonding agents perform well in terms of bonding strength in rebonded composite whether the surfaces are roughened / abraded or not. Removal of bulk of previous restoration may be necessary to remove to achieve necessary aesthetics. Standard polishing and finishing techniques should be used as the final step of repaired restorations. The occlusal and flexural forces have to be considered when there is a history of repeated failures (debonding or microleakage or loss of full or partial restoration) of restorations in GV Black's Class V lesions, because of abfraction. The need of repeated repair or replaced restorations cause frustrations, consumption of time and financial burden for both the operator and the patient if the underlying conditions are not recognized and corrected timely i.e. by occlusal adjustment or altering the functional loading that is axial, not lateral.

Maintenance of restorations

To minimize the failure, maintenance of the restorations is important. There are two types of maintenance required for aesthetic restorations; self care & professionals care. To maintain long term health, function and aesthetics, self care (Home Care) should be supported by regular professional care. Identifying and assessment of the risk factors for the development e.g. salivary hypofunction due to medications, autoimmune diseases and etc, dietary sugar consumption, oral hygiene behavior, utilization of service and socioeconomic factor, may be helpful tools to predict the longevity of the restorations. Newly developed protocols e.g. Cambra, may help identifying risk groups and design preventive treatment options to overcome the risk factors.

In case of high susceptibility to carious lesions and failures of restoration, chemotherapeutic measures to control the cariogenic microflora and candida, daily application of prescription strength fluoride, topical application of fluoride varnish (22000ppm), remineralizing agents, and sialogogues may have to be prescribed. Assessment of the activity of the disease, whether active (in a state of progression) or arrested (not progressing)

carious lesions, will also determine the need to repair of the restorations as arrested lesions need no repair. Also, in cases of rampant caries, usage of cariostatic, hybrid or resin modified glass ionomer restorative materials and deferring elective procedures until there is assurance that no caries will develop in the near future to increase the life of restorations. ■



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Direct composite restorations of fractured anterior teeth

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Clinical history: Male patient of age 32 years old presented with fractured upper anterior teeth. Clinical examination revealed an incisal third fracture of old composite restoration on tooth no. 11 and chipped incisal edges of tooth no 21. Patient had no complaints of pain or sensitivity on fractured teeth.

Clinical challenges: To restore fractured teeth with invisible margins, natural color and effects.

Treatment options:

- a. Direct composite resin restoration with non/minimal tooth preparation
- b. Indirect partial veneers with non/minimal tooth preparation
- c. Indirect full veneers with conventional tooth preparation

Patient's need/desire: Patient wanted invisible life-like (naturomimetic) restorations with minimal biological, financial and time (BFT) cost.

Selected treatment approach: Considering biological, financial and time (BFT) cost factors, direct composite resin restorations with minimal and non tooth preparation approach was chosen.

Techniques involved: Minimal tooth preparation, tooth protection, itching, bonding, lingual frame construction, staining, composite layering, and finishing, polishing and super polishing techniques.

Restoration plan: Graphic representation of restorative plan: The case was completed with a complex bi-layered shading technique (using any two groups of restorative materials and effect group in layering technique) to build tooth structure and to construct lingual matrix A3T (A3 Transparent) flowable resin was used.

Clinical steps

Fig. 1 - Fracture on tooth no. 11 & 21. Note the old composite resin restoration on tooth no 11



Fig. 2 - Close up view of fractured teeth on a black background



Fig. 3 - Restoration plan

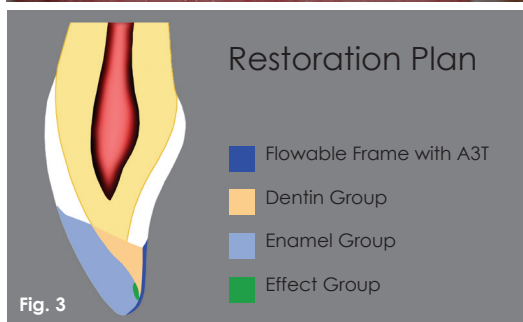


Fig. 4 - Old composite resin restoration of tooth no. 11 was removed carefully with a diamond point and the fracture margins were slightly beveled with diamond point no. 102R to increase the restoration contact surface area of enamel



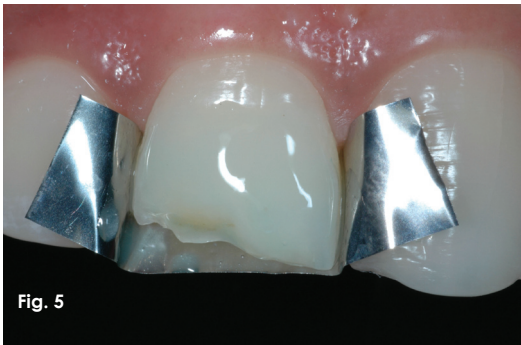


Fig. 5



Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10



Fig. 11



Fig. 12



Fig. 13



Fig. 14

Fig. 5 - Restoration process started first on tooth no. 11. Adjacent teeth were protected with a metal thin strip. Enamel and dentin were selectively etched

Fig. 6 - Note the properly acid etched enamel surface having a frosted white appearance

Fig. 7 - Exposed dentin is primed and air dried and bonding agent is applied uniformly on the tooth surface

Fig. 8 - To create the lingual frame on tooth no. 11, a plastic strip was placed and was held with the index finger. Then a thin layer of flowable resin (A3T) was injected and light cured for 10 seconds

Fig. 9 - After curing, the plastic strip was removed

Fig. 10 - Over the lingual resin matrix on tooth no 11, a layer of dentin group material of shade A1 was applied and cured for 20 seconds

Fig. 11 - After curing dentin layer properly a white resin stain was applied lightly with a brush to mask the fracture line and then it was light cured. After curing the stain layer, it was covered with a thin layer of enamel shade (INC)

Fig. 12 - The desired effect was checked. Correct use of effect (stain) group of materials in surface characterization gives a more natural look and also helps to mask the fractured lines

Fig. 13 - The final enamel layer was applied and contoured with plastic instrument before curing

Fig. 14 - Before light curing, the contoured enamel surface was smoothed with a brush to achieve a good surface adaptation and proper anatomical finish of the plastic stage. The final layer of enamel was then cured for 20 seconds

Fig. 15 - Finishing and Polishing material

Fig. 16 - Labial surface finishing done with Durastone white

Fig. 17 - Interproximal areas were finished with diamond point no SF215 and by finishing strips

Fig. 18 - Palatal surface of the restoration was finished with OneGloss Midi points. OneGloss selectively finishes only composite resin restorations and does not abrade the tooth structure

Fig. 19 - Labial surface was polished sequentially in descending abrasive grit size using Super Snap green & red disk

Fig. 20 - Note the polishing surface, which was ready for super polishing or luster

Fig. 21 - Diamond paste was applied over restoration surface for super polishing

Fig. 22 - Super polishing was done using Buff Disk and diamond paste

Fig. 23 - Note the super gloss restoration surface mimicking natural tooth

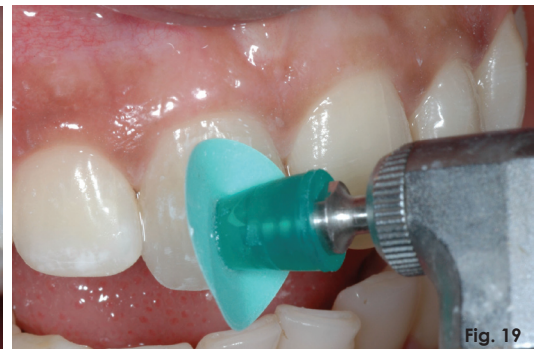
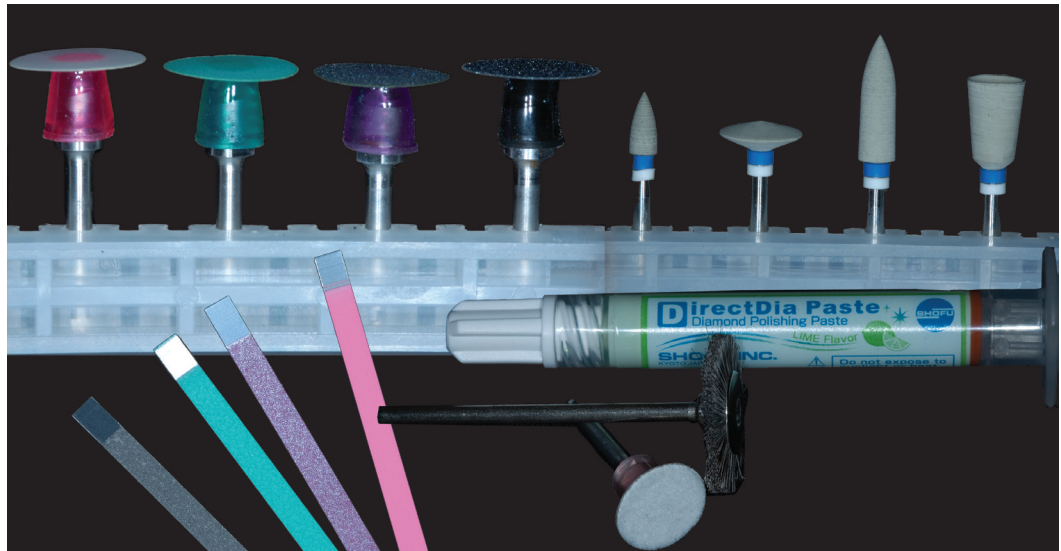




Fig. 24



Fig. 25



Fig. 26



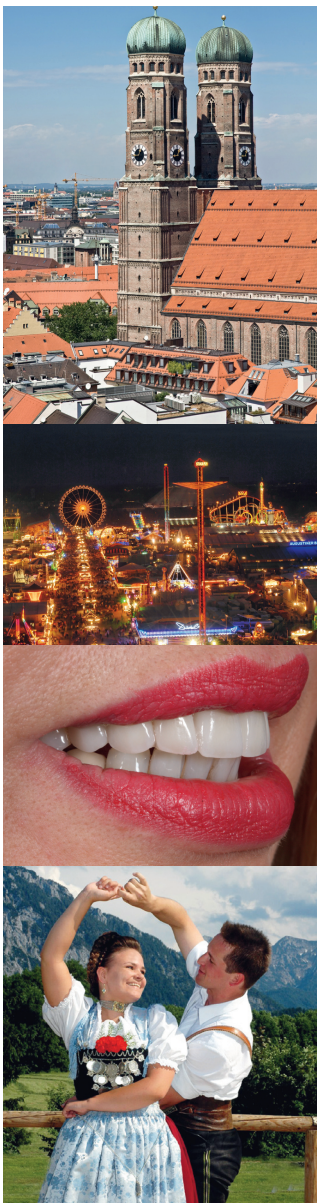
Fig. 27

Fig. 24 - Once restoration of tooth no. 11 was completed, tooth no. 21 was isolated with Teflon tape (plumbing tape) and the tooth build up process was completed and then smoothed with brush

Fig. 25 - Tooth no. 21 after the build-up and ready for the final curing. The restoration was finished, polished and super polished as in tooth no. 11

Fig. 26 - Restored teeth after finishing and polishing on a black background

Fig. 27 - Restored teeth after one week time



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MiCD-customized case finishing concept & clinical protocol

¹Sushil Koirala

Abstract

Case finishing is one of the important clinical steps in dentistry. Aesthetic, functional forces and oral health are the three fundamental components that need to be considered during case finishing. Aesthetic components are clinically visible and guided by subjective analysis (perception) of the patient and the clinician. However, the force components are invisible, and their adverse effects are not easily appreciated clinically until the effects become chronic. Moreover, the force components require special tools and clinical techniques to demonstrate and measure them clinically. Therefore, the force is the most neglected component in cosmetic dentistry during case finishing. When the force components are not addressed properly during the treatment, clinicians may encounter various clinical problems like; damaged restorations (veneers, onlay, crowns, and bridges), fractured teeth, tooth mobility, abnormal tooth wear and sensitivity, pain in the teeth, muscles, and jaw joints, increased neck pain, ear pain and headache. In cosmetic dentistry forces are finished by depending on articulating paper mark interpretation and patient's proprioception feedback. It has been documented in the literature that articulating paper is a poor indicator of occlusal disharmony and cannot measure occlusal load and timing of tooth contacts. Proper use of tools and techniques can precisely and objectively measure the necessary occlusal parameters required for finishing the force components in cosmetic dentistry. MiCD-customized case finishing (MCCF) integrates the force finishing concept into conventional case finishing protocol of dentistry, in the hope that it will help practitioners to achieve long term optimum results in terms of health, function and aesthetics and high patient satisfaction with minimal biological cost.

Key words: Case finishing, aesthetic finishing, force finishing, micro aesthetics, force components, canine guidance, disclusion timing

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Learning Objectives

1. To understand the fundamental components of case finishing and their role in cosmetic dentistry
2. To understand the force and aesthetic finishing concept and clinical techniques
3. To recognize fundamental tools and materials required for quality case finishing in cosmetic dentistry
4. To learn the minimally invasive cosmetic dentistry(MiCD) customized case finishing concept and clinical protocol

Introduction

The treatment modalities and protocol of health-care service should be aimed at the establishment of health and the conservation of the human body with its natural function and aesthetics. The comprehensive concept of minimally invasive cosmetic dentistry (MiCD) and its treatment protocol were introduced in 2009 with the basic aim of a clinician effecting optimum clinical therapeutic improvements in smile enhancement, while performing corrective procedures that require as little clinical intervention as possible.¹ The intervention level of

the treatment in MiCD depends on the type of smile defects and the aesthetic needs of the patient.¹ Five core principles (Fig. 1) of MiCD concept helps to guide clinician in achieving desired smile enhancement with minimal clinical intervention. However, the core value of principles must be adapted from case selection to the final case finishing stages. Proper case finishing is not possible without understanding its two components, namely the micro aesthetics, and the occlusal forces. It is however, the force component that is often neglected, nor focused upon properly, in cosmetic dentistry. This article describes a MiCD-customized case finishing (MCCF) concept & protocol that respects both force & aesthetic components.

MiCD-customized case finishing (MCCF) concept

Case finishing is one of the important parts of any clinical treatment in dentistry. It has three major components; aesthetics, overall health, and occlusal function, that all need to be considered. It is interesting to note that case finishing is viewed differently in different disciplines of dental medicine. In orthodontics, case finishing fundamentally focuses on six keys to occlusion (Fig. 3) described by Andrew² whereas in cosmetic dentistry, it is considered as the last step of the clinical procedure to concentrate on refining the micro aesthetic components of the smile. Cosmetic dentists spend their clinical time and effort more on aesthetic final result. This is because, aesthetic components are visible to both the clinician and patient, where the outcome can immediately be appreciated. However, the force components are invisible, and their negative effects are not easily appreciated clinically until the effects become chronic. Another reason that force finishing can be overlooked, is that it requires special tools and clinical techniques to demonstrate and measure the force factors clinically. Therefore, the force is the most neglected component in cosmetic dentistry during case finishing.

In cosmetic dentistry forces are finished by

Fig. 1 - MiCD core principles¹

Sooner the better: Follow early diagnosis & intervention approach

Smile Design Wheel approach: Understand psychology, establish health, restore function and enhance aesthetics (PHFA-sequences of Smile Design Wheel) Fig. 2

Do no harm: Minimize the possible biological cost

Evidence based selection: Select materials, tools, techniques and protocols based on scientific evidences

Keep in touch: Encourage regular follow up and maintenance

depending on articulating paper mark

interpretation and patient's proprioception feedback. It has been documented in the literature that articulating paper is a poor indicator of occlusal disharmony,³⁻⁵ and studies show that mark size varies with the same applied load, with different thickness of paper, surface texture of tooth and restorations and that mark interpretation is an operator-based subjective procedure. Moreover, paper cannot measure the timing of forces of occlusion.³⁻⁶

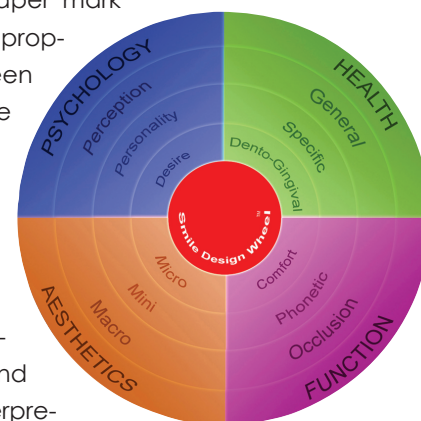


Fig. 2 - Smile Design Wheel

Proper case finishing protocol must be based on both subjective and objective analysis. To measure the occlusal load and timing of forces of occlusion it is necessary to use proper tools, which can precisely and objectively measures the necessary occlusal parameters required in cosmetic case finishing. Computerized instrumentation to analyze occlusal forces was introduced

Fig. 3 - Andrew's six keys to occlusion²

- I. Molar relationship: The distal surface of the disto-buccal cusp of the upper first molar occludes with the mesial surface of the mesio-buccal cusp of the lower second permanent molar
- II. Crown angulation (mesio-distal tip): The gingival portion of each crown is distal to the incisal portion and varied with each tooth type
- III. Crown inclination (labio-lingual, bucco-lingual) : Anterior teeth (incisors) are at a sufficient angulation to prevent overeruption, upper posterior teeth-lingual tip is constant and similar from 3-5 and increased in the molars, lower posterior teeth-lingual tip increases progressively from the canines to the molar
- IV. No rotations
- V. No spaces
- VI. Flat occlusal planes

Fig. 4 - Jaw position theories

1. **Centric relation theory (Clyde Schuyler):**⁸ The occlusion is determined by how the ligaments brace the components of the jaw joint, particularly the rearmost hinge axis. There are various clinical techniques proposed to record CR. Bimanual manipulation technique of Dawson⁹ and Lucia jig or leaf gauge technique using, as reported by Long,¹⁰ are popular techniques to position the mandible in CR. Prior to this, chin-point guidance and swallow techniques were used to locate and record CR.
2. **Neuromuscular theory (Jankelson):**¹¹ The occlusion is determined by gravity and based on where the jaw muscles are most relaxed. TENS is employed to "relax" the muscles
3. **Intercuspal theory:** The occlusion is determined by the habitual fit of the most tooth contact.
4. **Anterior protrusive position theory (Gelb 4 /7 position):**¹² The occlusion is determined by how the muscles brace the components of the jaw joint. Gelb 4/7 jaw position is found by using appliances to open the occlusion and reposition the mandible forward and down of the true center of the Glenoid Fossa.

by Tekscan Inc (South Boston, MA, USA) in 1984 as T-Scan I.⁷ Over the past 27 years, the technology has evolved to be a very precise diagnostic and treatment tool that is used to manage the force components in any conventional case finishing approach to dentistry.

Every clinical case is different as it is related to a patient's status of health, their functional requirements, and their aesthetic needs and desires. Function is directly related to the forces that a patient generates within his/her stomatognathic system. There are basically four different theories that clini-

cians can view and think about occlusion. Each of these theories has their value, and treatments that are founded on each have been successful. These theories of occlusion differ in the consideration of where the jaw or temporomandibular joint should be positioned during the treatment which are known as "Jaw Position Theories"(Fig.4).

It is however, all of these theories have similar agreement in the following issues.

1. Teeth during mandibular closure: All teeth should occlude simultaneously in mandibular closure movement¹³⁻¹⁶
2. Occlusal load distribution on arch: An equal percentage of occlusal forces should be shared between the right and left arch halves
3. Occlusal load on tooth : An equal percentage of occlusal force should be distributed on each tooth counterpart
4. Excursive contacts: Anterior teeth should immediately disclude the posterior teeth in excursive movements¹³⁻¹⁶

Based on the laterotrusive movements from centric occlusion, various concepts of functional occlusion were recognized and advocated: balanced occlusion^{17,18} , canine protected occlusion¹⁹⁻²⁶, group function occlusion²⁷⁻³¹, mixed canine-protected and group function³², flat plane (attrition) teeth occlusion^{33,34}, biologic (multi-varied, physiologic occlusion³⁵ However, no single type of functional occlusion has been found to predominate in nature and there appears to be no scientific evidence to support one occlusal scheme over other.³⁶

Therefore, the knowledge of literature and research evidences along with individual clinical experiences and accepted parameters of care should always be considered while selecting occlusal scheme during cosmetic dental treatment. And case fining procedures should not be based on a "one fit for all" concept, and must be customized and designed to fit the patient's aesthetic desires, functional requirements and physiological limits. MCCF integrates the force finishing concept into conventional case finishing protocol in the hope that it will help

Fig. 5 - Mechanism of occlusion forces alteration¹⁵

The clinicians can alter the following five areas during occlusal scheme preparation to have an effect on occlusal forces:¹⁵

1. **Intercuspal position (ICP) contacts:** The restorative dentists can control which teeth come in contact and how many tooth contacts there are during closure in the ICP
2. **Excursive contacts:** By altering the number and type of tooth contacts in eccentric excursions, the restorative dentists have the ability to change the muscular contraction and the distribution of forces.
3. **Angle of tooth contacts:** It is well known that the depth of the overbite or steepness of the angle of guidance of the teeth will have an impact on how forces are distributed.^{37,38} That angle of impact not only will affect on the distribution of the force, but also the ability of the muscle to contract.
4. **Condylar position:** The condylar position chosen will have a dramatic impact on the ability to control which teeth contact each other and when they contact.
5. **Vertical dimension of occlusion (VDO):** Vertical dimension of occlusion can be opened or closed when restoring at least one arch. Decreased vertical dimension increases the occlusal forces.

practitioners to achieve long term optimum results in terms of health, function, aesthetics and patient satisfaction with minimal biological cost. MCCF can be divided into three clinical components;

- Force finishing
- Aesthetic finishing
- Finishing evaluation

Force finishing

The concept of force finishing is new in cosmetic dentistry and should not be confused with the conventional occlusal equilibration or occlusal adjustment process. Force finishing concept is based on universal principles of forces balance and forces loading timing during dynamic occlusion. To achieve precise force finishing in restorative dentistry, clinicians need to plan the occlusal end point goals in advance. This is required because the force finishing steps alone cannot refine the major occlusal discrepancies of the patient. Hence, proper jaw positioning, angulations and establishment of tooth form (natural anatomy), must be completed before proceeding to MCCF. There are basically five areas during occlusal scheme preparation where clinicians have control to have an effect on the force components. (Fig. 5).

The force finishing portion of MCCF procedures requires the use of digital occlusal technology that can precisely and objectively measure clinical occlusal force data, while displaying the findings for clinical interpretation and treatment. The objective and precise clinical data helps clinicians to achieve tooth contact forces, and tooth contact timing sequences, that are preservative, rather than destructive, to the final case end-result. However, in cosmetic dentistry the role of force finishing is generally overlooked, minimized or ignored. The following are some of the clinical problems that clinicians encounter when they ignore or are unable to harmonize occlusal forces after the treatment.

- Damaged restorations (veneers, onlay, crowns, bridges)
- Fractured teeth
- Tooth mobility
- Abnormal tooth wear and sensitivity
- Pain in the teeth, muscles, and jaw joints
- Increased neck pain, ear pain and

Fig. 6 - Force finishing clinical facts

1. Unilateral tooth contacts increase force in the opposite joint.
2. Bilateral even tooth contacts during ICP gives more stability to the teeth, muscles and Joints.
3. When the number of occluding teeth increases, the total percentage of forces to each tooth decreases.
4. Vertical forces created by tooth contacts are well accepted by the periodontal ligament (PDL), but horizontal forces cannot be effectively dissipated,³⁹ these forces may create pathologic bone responses or elicit neuromuscular reflex activity in an attempt to avoid, or guard against the incline plane contacts.⁴⁰ Hence, directing the occlusal force through the long axis of the tooth (axial loading) should be a goal of force finishing in the posterior teeth. Axial loading can be accomplished by cusp tip-to flat surface contacts or by creating reciprocal incline contacts (also known as tripodization).
5. The amount of the force that can be generated between teeth depends on the distance the teeth are from the temporomandibular joint, combined with applied muscular force vectors (Fulcrum Principle). Greater force can be applied to the posterior teeth, than to the anterior teeth.⁴¹⁻⁴³ Posterior teeth function effectively when accepting axial forces (axial loading) applied during closure of the mouth. They accept these forces well, primarily due to their position in arch is because the force can be directed through long axes and thus dissipated effectively.¹⁶
6. The anterior teeth are not positioned well in arches to accept heavy axial force. They are normally positioned at a labial angle to the direction of closure, so loading them axially is nearly impossible.⁴⁴
7. Anterior teeth, unlike posterior teeth, are in proper position to accept horizontal forces of eccentric mandibular movements.^{43,45,46}
8. The anterior teeth should immediately disclude the posterior teeth in excursive movements^{13,14,16} resulting in friction-free excursive movements that limit wear on teeth and activate low levels of excursive muscle function.⁴⁷
9. Canines are best suited to accept the horizontal forces that occur during eccentric movements.^{40,45,48} This is because;
 - a. They have the longest and the largest roots and therefore the best crown/root ratio.^{44,49}
 - b. They are surrounded by dense compact bone, which tolerates the forces better than does the medullary bone found around posterior teeth.⁵⁰
 - c. The canines are centered on sensory input and the resultant effect on the muscles of mastication. Apparently, fewer muscles are active when canines contact during eccentric movements than when posterior teeth contact.^{51,52}
 - d. Lower levels of muscular activity would decrease forces to the dental and joint structures, minimizing pathosis. It is therefore, suggested that during force finishing of left or right laterotrusive excursion movements, "canine guidance" is the preferred excursive control, so as to best dissipate any damaging horizontal forces. When canine guidance is not possible to achieve during case finishing, the most favorable alternative to canine guidance is group function. The most desirable group function consists of the canines, premolars, and sometimes the mesiobuccal cusp of the first molar. Any laterotrusive contacts more than the mesial portion of the first molar are not desirable because of the increased amount of muscle force that can be created as the contact gets closer to the fulcrum (TMJ).¹⁶

Fig. 7 - T-Scan III: Digital occlusal analysis tool use to measure occlusal force percentage and tooth contacts timing

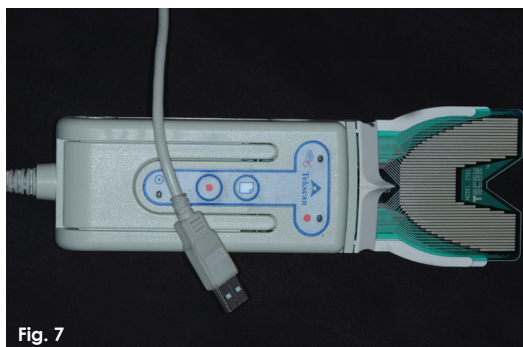


Fig. 7

Fig. 8 - Articulating paper with holder, a necessary item to locate the tooth contacts point and surface area during force finishing



Fig. 8

Fig. 9 - Dura Green stone, Diamond points and Dura White stone can be used to selectively contour the pressure spots during force finishing

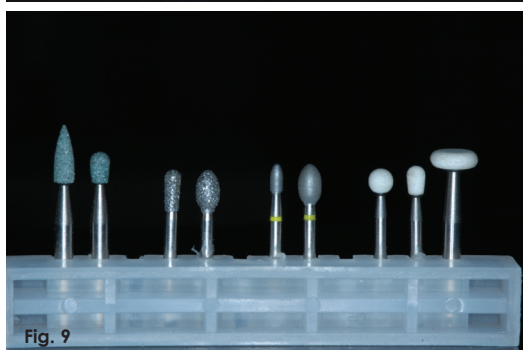


Fig. 9

Fig. 10 - Diamond impregnated silicone points to finish and polish the contoured tooth and restoration surfaces

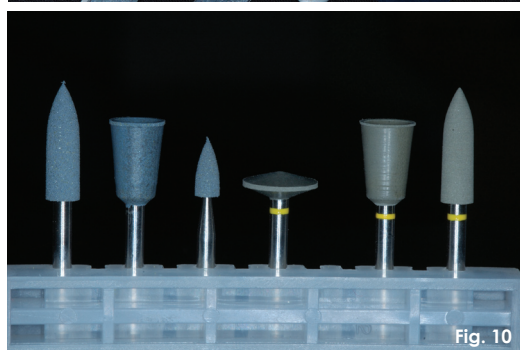


Fig. 10

headache

To achieve the quality force finishing results in dentistry, the following clinical conditions must be fulfilled during the force finishing process.

- Even and simultaneous contacts of all teeth during mandibular closure
- Distribution of nearly equal force percentage between the right and left arch halves
- Distribution of more tooth contact forces on posterior teeth, less on premolar teeth, with only light anterior contacts
- The center of force (COF) should be in the middle of the distribution of all contacting teeth.

- The anterior teeth should immediately disclude the posterior teeth in excursive movements.¹³⁻¹⁶

Optimally, after proper force finishing, all teeth should come in contact with one another at about the same time and with harmonized occlusal forces and measurably short disclusion timing. When this does not occur, the clinical case is considered to be unbalanced and poorly force finished. Force finishing clinical facts are shown in Fig. 6.

Aesthetic finishing

The aesthetic outcome is one of the major concerns of all patients seeking cosmetic den-

Fig. 11 - Diamond and Dura White stone points to contour and texture the tooth and restoration surfaces.

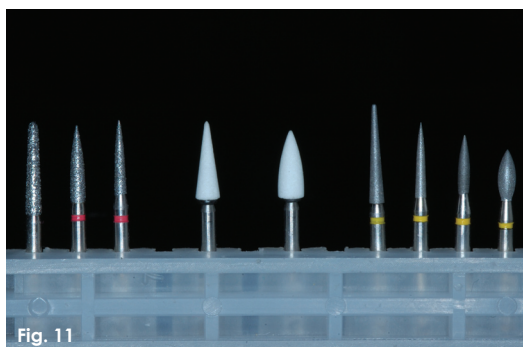


Fig. 11

Fig. 12 - Diamond impregnated silicone points to finish and polish the contoured tooth and restorations surfaces

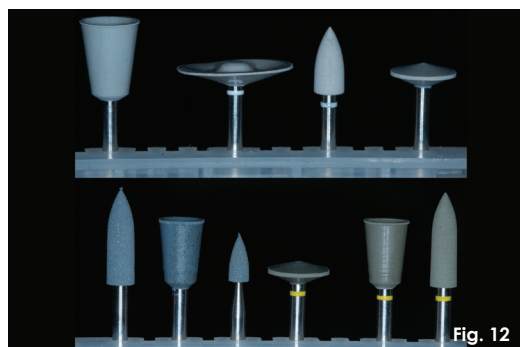


Fig. 12

Fig. 13 - Super Snap disk and strips: For labial and inter dental surfaces finishing and polishing

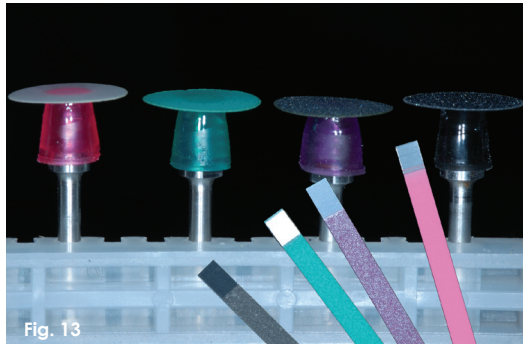


Fig. 13

Fig. 14 - Diamond paste, diamond impregnated silicone points and Robinson brush are used to achieve super polishing or enamel like luster of the restoration and tooth surfaces



Fig. 14

tal treatment. The aesthetic finishing process in cosmetic dentistry involves establishing high surface gloss, and creating proper micro smile aesthetic characteristics. These include proper tooth size ratio, axial inclination, open incisal embrasures, proper connector location, proper contact point progression, incorporating surface micro texture, surface gloss or luster, inciso-gingival shade progression, and special surface effects on the facial surfaces. Additionally, gingival aesthetic characteristics to incorporate during case finishing are the control of the tissue contour, embrasure heights, gingival zenith, and establishing uniform heights (position or level) of the tissues around all restorations.

To improve the practicality of clinical aesthetic case finishing procedures, the procedures are divided into three clinical steps;

Aesthetic Contouring: The restoration is grossly reduced for the reproduction of the natural size, shape and other details of the tooth form.⁵³ Re-establishing the contact with adjacent an opposing teeth to a normal and functional form is achieved in this step.⁵³

Finishing: This is a finishing process to establish an even, well adapted junction between the tooth surface and the restorations.

Aesthetic Touch up: Necessary minor adjustments to achieve natural surfaces details by placing texture, grooves, pits, and other special surface effects.

Polishing: This step smoothes restorations to an enamel-like luster. For clinical convenience this process can be further divided into three steps:

Pre-polishing: Removing the remaining surfaces scratches from the aesthetic touch up process

Polishing: Achieving a blemish - free and smooth surfaces with no visible scratches

Fig. 15 - Aesthetic finishing clinical facts

1. A rough restoration surface allows dental plaque to adhere, which can promote secondary caries and periodontal diseases.⁵⁴ Because the free surface energy of uneven surfaces is lower than that of smooth surfaces, microorganisms can easily adhere and colonize.^{55,56} As a result, the susceptibility to oral soft tissue infection and caries can increase^{57,58}
2. Rough surface of the final restoration promotes restoration marginal discoloration⁵⁹⁻⁶¹ which can decrease the aesthetic quality of the restorations⁶²
3. Surface gloss plays an important role in the appearance of tooth-colored restorative resins⁶³ and is a desirable characteristic that allows restorative materials to better mimic the appearance of the enamel^{64,65}
4. A smooth and well polished surface improves the flexural strength of the restorations and decrease abrasion against the opposing teeth^{66,67}
5. The quality of intraoral aesthetic finishing is depends on the restorative materials used, the finishing techniques, the finishing tools and materials selected, and the skill of the operator
6. The quality of polishing of the restoration surfaces is vital for long-term health, function and aesthetics of the oral tissues

Super polishing: Creating enamel-like luster or gloss.

Aesthetic finishing clinical facts are shown in Fig. 15.

Finishing evaluation

Postoperative clinical evaluation is one of the fundamental requirements in the "Keep in Touch" phase of MiCD treatment protocol.¹ Generally one week after the case finishing, the case should be re-evaluated in terms of health, comfort and aesthetics through clinical examination, digital pictures and other necessary guiding tools. The end results of force finishing should be re-confirmed before final case documentation.

MiCD Customized Case Finishing (MCCF) Pro-

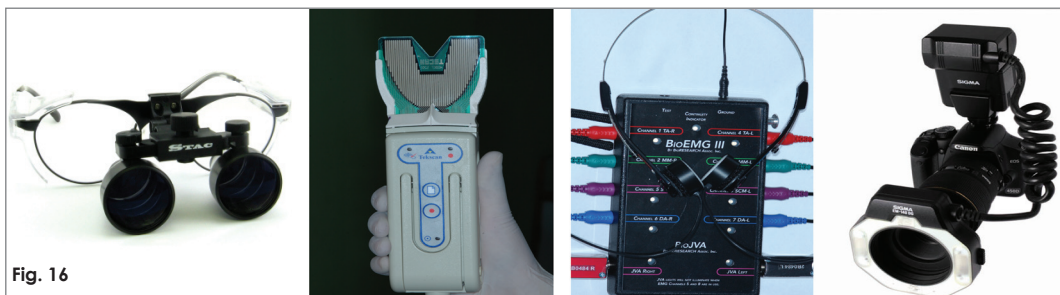


Fig. 16 - Magnification dental loupe, T-Scan III, BioJVA (Jaw Vibration Analysis) BioEMG (Electromyography) and Digital SLR camera are used as the guiding tools to evaluate the force finishing quality.

Fig. 16

Table 1:		Type I - MiCD case finishing protocol	
Clinical steps	Finishing tools	Guiding tools	
<p>Step I : Aesthetic finishing</p> <p>Aesthetic contouring</p> <ol style="list-style-type: none"> 1. Reproduce natural size, shape and other details of the tooth form 2. Re-establish the contact with adjacent an opposing teeth to a normal and functional form is achieved in this step <p>Finishing</p> <ol style="list-style-type: none"> 1. Establish an even, well adapted junction between the tooth surface and the restorations. <p>Aesthetic touch up</p> <ol style="list-style-type: none"> 1. Achieve natural surfaces details by placing texture, grooves, pits, and other special surface effects <p>Polishing</p> <ol style="list-style-type: none"> 1. <i>Pre-polishing</i>: Remove the remaining surface scratches from the aesthetic touch up process 2. <i>Polishing</i>: Establish a blemish free and smooth surfaces with no visible scratches on the restoration 3. <i>Super polishing</i>: Polish restoration to enamel-like luster. 	Aesthetic finishing kit	<ul style="list-style-type: none"> • Dental loupe • Digital pictures • Digital X-ray (To check restoration margin fitting , finishing and over hands) 	
<p>Step II : Finishing evaluation</p> <ol style="list-style-type: none"> 1. Evaluate aesthetics, health (dental and gingival) and comfort status 2. Document the final case finishing results digitally 	Aesthetic finishing kit	<ul style="list-style-type: none"> • Dental loupe • Digital pictures 	

tocol

Based on the patient's aesthetic desires, and level of case sensitivity towards the occlusal force components (tooth contact forces & contact timing sequences) MCF can be divided into three clinical types.

Type I-MCCF: When forces are not part of creating the aesthetic case changes; non load bearing anterior and posterior restorations; tooth whitening procedures, reductive & additive contouring (both the teeth & gingival tissues) which their corrections does not alter existing occlusal scheme, which are generally finished utilizing Type I-MCCF protocol (Table.1).

Type II-MCCF: When aesthetic cases are sensitive to tooth contact forces, because a major restoration is being fabricated on the

load bearing areas of the anterior or posterior teeth (as when utilizing inlays, onlays, overlays, crowns & bridges, veneers, dentures, or performing a re-restoration of frequently fractured restorations),force finishing procedures should precede aesthetic case finishing. This will improve the long-term clinical success of the restoration and create effective functional health. Force finishing in type II cases requires using digital technology (T- Scan III) that can measure and display the underlying tooth contacts forces precisely and objectively. The type II-MCCF finishing protocol is shown in (Table.2).

Type III-MCCF: Complex aesthetic cases (full mouth restoration, orthodontic treatment, implant restorations, cases with para -functional habits, restorations that alter the anterior guidance, cases with a known history of TMD symp-

Table 2:		Type II – MiCD case finishing protocol	
Clinical steps	Finishing tools	Guiding tools	
<p>Step I : Force finishing</p> <p>During centric closure movement</p> <ol style="list-style-type: none"> 1. Bring all the teeth into occlusal contact by selective contouring 2. Measure tooth contacts forces and timing sequences on the restorations 3. Adjust early contacts to delay them from contact which improves contact simultaneity 4. Adjust high contact forces on the restoration 5. Selectively adjust tooth contact forces on restoration until force equality is established throughout the case <p>During excursive movements</p> <ol style="list-style-type: none"> 1. Check for prolonged frictional contacts on the restorations during right, left and protrusive movements 2. Remove all prolonged frictional contacts on the restorations 	Force finishing kit	<ul style="list-style-type: none"> • T-Scan III • Articulating paper 	
<p>Step II : Aesthetic finishing</p> <p>Aesthetic touch up</p> <ol style="list-style-type: none"> 1. Achieve natural surfaces details by placing texture, grooves, pits, and other special surface effects. <p>Polishing</p> <ol style="list-style-type: none"> 1. <i>Pre-polishing</i>-remove the remaining surface scratches from the aesthetic touch up process 2. <i>Polishing</i>- Establish a blemish free and smooth surfaces with no visible scratches on the restoration 3. <i>Super polishing</i>- Polish restoration to enamel-like luster 	Aesthetic finishing kit	<ul style="list-style-type: none"> • Dental loupe • Digital pictures • Digital X-ray (To check restoration margin fitting, finishing and over hangs) 	
<p>Step III: Finishing evaluation</p> <ol style="list-style-type: none"> 1. Evaluate aesthetics, health (dental and gingival) and comfort status 2. Confirm force finishing end results 3. Document the final case finishing results digitally 		<ul style="list-style-type: none"> • Dental loupe • Digital pictures • T- Scan III 	

toms) require significant tooth contact force & timing management. In these complex restorative cases, force finishing is performed before aesthetic finishing is accomplished so as to achieve enhanced occlusal function, ideal aesthetics, both combined with teeth, muscles and joints harmony. The Type III-MCCF protocol is shown in (Table 3).

All three types force finishing should always

be in harmony with the aesthetic results. After force finishing, the micro aesthetics elements should be re-examined, and cases should be completed with the necessary aesthetic touch-ups, and super polishing of all restorations. It should be remembered that all force finishing process should be followed by aesthetic finishing to successfully complete the cases.

Table 3:		Type III – MiCD case finishing protocol	
Clinical steps	Finishing tools	Guiding tools	
<p>Step I : Force finishing</p> <p><i>During centric closure movement</i></p> <ol style="list-style-type: none"> 1. Bring all the teeth in occlusal contacts by selective contouring 2. Measure tooth contact forces & timing sequences 3. Adjust early high pressure points, one by one 4. Equalize right and left arch half force percentage 5. Distribute nearly equal forces percentage on each posterior tooth counterpart, one by one (i.e. left 1st molar region should nearly equal right 1st molar region force %) 6. Keep light tooth contacts (less force %) in the anterior region 7. Check the location of centre of force (COF) and bring it down the midline and to the center of the distribution of all contacting teeth 8. Achieve simultaneous contacts of all teeth during mandibular closure 9. Selectively adjust tooth contacts timing of implant restorations to delay them from masking initial occlusal contact until after the nearby (to the implants) natural teeth make moderate occlusal contact force <p><i>During excursive movements</i></p> <ol style="list-style-type: none"> 1. Check for prolonged frictional contacts on the restorations during right, left and protrusive movements 2. Remove all prolonged frictional contacts on the restorations so that the disclusion time is reduced 3. Achieve canine protected guidance whenever possible 	Force finishing kit	<ul style="list-style-type: none"> • T-Scan III • Articulating paper 	
<p>Step II : Aesthetic finishing</p> <p><i>Aesthetic touch up:</i></p> <ol style="list-style-type: none"> 1. Necessary minor adjustments to achieve natural surfaces details by placing texture, grooves, pits, and other special surface effects <p><i>Polishing</i></p> <ol style="list-style-type: none"> 1. <i>Pre- polishing-</i> Remove the remaining surface scratches from the aesthetic touch up process 2. <i>Polishing-</i> Establish a blemish free and smooth surfaces with no visible scratches on the restoration 3. <i>Super polishing-</i> Polish restoration to enamel- like luster 	Aesthetic finishing kit	<ul style="list-style-type: none"> • Dental loupe • Digital pictures • Digital X-ray (To check restoration margin fitting, finishing and over hands) 	
<p>Step III : Finishing evaluation</p> <ol style="list-style-type: none"> 1. Evaluate aesthetics, health (dental and gingival) and comfort status 2. Confirm force finishing end results 3. Document the final case finishing results digitally 		<ul style="list-style-type: none"> • Dental loupe • Digital pictures • T- Scan III • Jaw Vibration Analysis (JVA) • Electromyography (EMG) 	

Conclusion

In the performance of cosmetic dentistry the force components have frequently been neglected or misunderstood. Therefore, the physical strength of the tooth colored restorative materials is still an important topic in cosmetic dentistry. The chosen restorative materials, are often much stronger than the natural teeth, because the clinician hopes the selected materials will overcome potential fracture of the restorations. However, it is necessary to understand that the highly concentrated occlusal force locations within the occlusal scheme, may not always fracture the restorations, but will create other problems with the teeth, muscles, and/or joints in some patients. Therefore, if clinician overcomes the fracturing of the restorations through material choice, he or she may actually be ignoring the underlying forces factors.⁶⁸

It is to be noted that , whatever the theory or concept of occlusal scheme is selected during the treatment procedures, the role of MiCD customized case finishing (MCCF) becomes paramount to achieve long term optimum results in terms of health, function , aesthetics and high patient's satisfaction with minimal biological cost. ■

Disclosure

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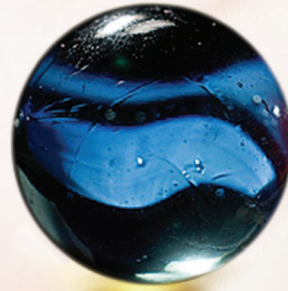
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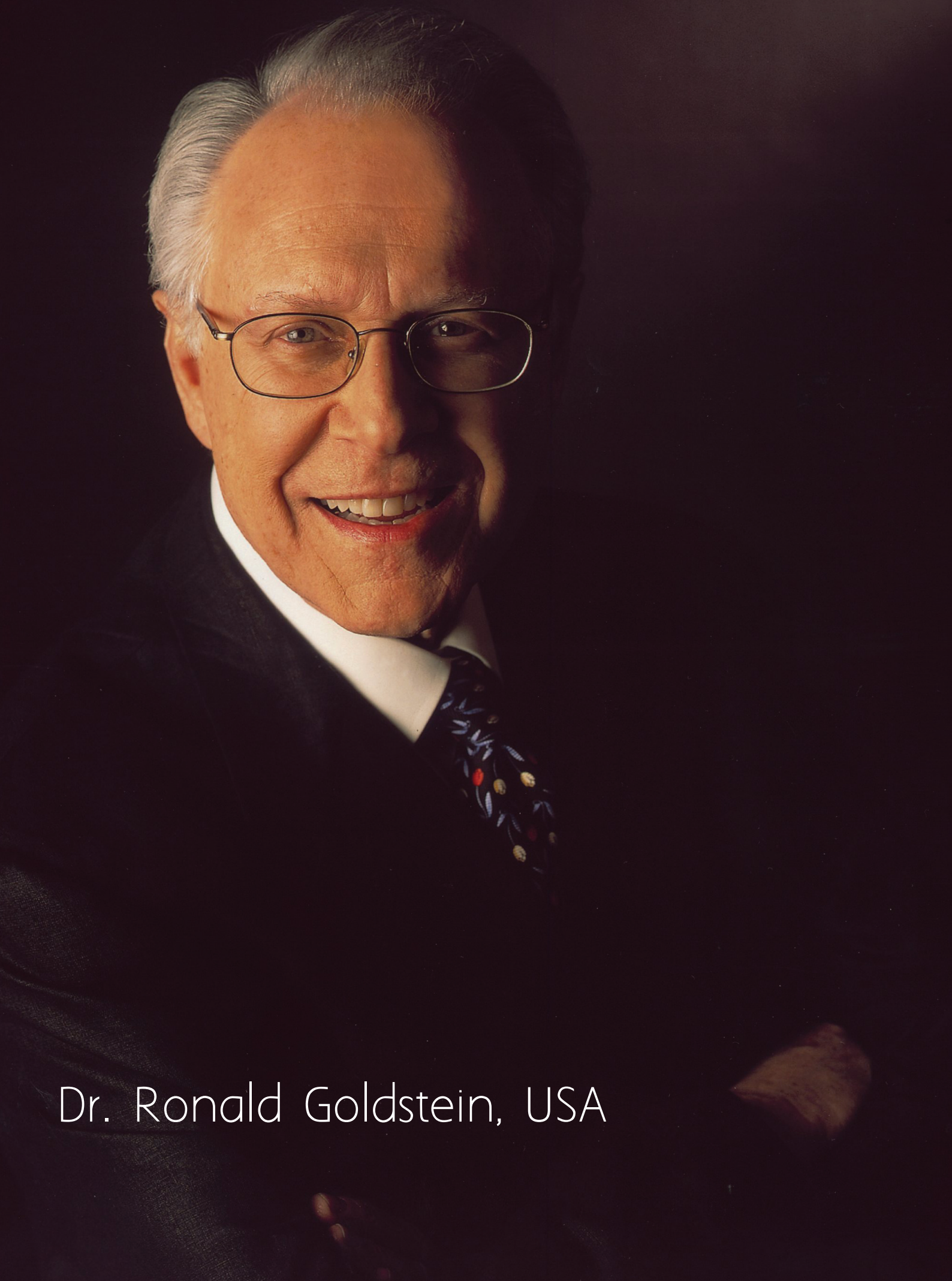
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Exclusive Interview



Dr. Ronald Goldstein, USA

I HAVE BEEN AT THE FOREFRONT OF MINIMALLY INVASIVE COSMETIC DENTISTRY DURING MY ENTIRE CAREER...

Dr. Ronald Goldstein has long been considered the 'architect' of modern aesthetic dentistry and wrote the first comprehensive textbook *Esthetics in Dentistry* in 1976. His pioneering efforts to make dentists aware of their patients' need for more attractive smiles led to the first published consumer book, *Change Your Smile*, now in its 4th edition, and subsequently published in ten languages worldwide.

Dr. Goldstein was recently honored by the Georgia Health Sciences University School of Dentistry, which named the "Ronald Goldstein Center for Esthetic and Implant Dentistry" and also devoted an ongoing learning center for Dr. Goldstein's memoirs and memorabilia. In addition, the Hebrew University Dental School in Jerusalem established the Dr. Ronald E. Goldstein Research Center for Dental Materials and Esthetics in Dentistry in 2000.

Dr. Goldstein is considered a teacher of teachers. In the early 1960s his concepts were used to develop virtually all the modern direct bonding techniques utilized to this day to correct esthetic deformities. He has given over 600 lecture presentations, authored or co-authored ten textbooks, 125 clinical articles, plus featured in over 400 TV, radio, magazine and newspaper interviews.

In 1992 the American Academy of Esthetic Dentistry awarded him the first Charles L. Pincus Award for his contributions to Aesthetic Dentistry. The same year, he was awarded the Outstanding Contribution to Cosmetic Dentistry Award from the American Academy of Cosmetic Dentistry. A Clinical Professor at 3 universities, in 1997 Dr. Goldstein was bestowed the Alpha Omega International Dental Fraternity's most prestigious award for "meritorious contributions to dentistry and its allied sciences," joining past recipients Albert Einstein and Jonas Salk.

Dr. Goldstein is married to Judy, and the father of three dentists and a physician, plus 11 grandchildren. He practices in Atlanta, Georgia, USA.

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 dentistry around the world. In this issue, we are proud and honored to present an exclusive interview of **Dr. Ronald Goldstein (USA)**.

Q. You have dedicated over five decades of your valuable life time in the field of clinical dentistry. How did you start your operations and what made you attracted to cosmetic dentistry?

In the early 1960s I was disturbed by the lack of research on motivation for looking better. There was no research in dentistry on the subject, so I authored and published the first dental article on what motivates people to want to look better based on a 2-year study I did with the Polaroid corporation that showed that dentists were not usually receptive to their patients' desires for improved smiles. It was this important finding that drove me to intensify my research and later intensify my writing to show the world the importance of looking their best. And it was this study that would change my life and cause me to devote my professional career to changing the dental profession.

Q. Cosmetic dentistry is defined by various clinicians in various ways. Would you kindly explain to us actually what it is? And, how one can incorporate it in general practice?

Cosmetic dentistry by definition is anything related to helping make the smile more attractive. Actually I extended the definition to include the face since what we do can and does have a dramatic effect on physical appearance. Therefore, cosmetic dentistry deals with total facial aesthetics.

When I first told my dentist father that I wanted to devote my career to aesthetic dentistry he said 'But every dentist does some cosmetic dentistry' and I answered him that I was going to make it something special es-

pecially in meeting the psychological and physical needs of our patients. So the dentist who wants to do more in cosmetic dentistry must do his or her homework. First, read all there is to read on the subject. My first textbook, *Aesthetics in Dentistry* (Amazon) is a good starting place and then to take as many courses as possible on the various aspects of cosmetic dentistry. And finally, let your patients know via a newsletter of your 'new focus' on cosmetic dentistry. But be sure you can 'deliver the goods' before doing so.

Q. Patients generally want beautiful and healthy smiles. However, personal desire generally makes a difference in treatment planning; would you please tell us how to maintain harmony between desires and the treatment reality?

I just completed a full mouth reconstruction on a patient whose cosmetic desire was to have a perfect smile. However, she had a Class II maxillary protrusion and the only way she could have the look she wanted was to either have a surgical advancement through orthognathic surgery, or exist with an acquired centric occlusion instead of the more retruded centric she was comfortable with. So here was a situation where the patient had been searching for a dentist to give her the look and the bite she wanted. Now after seeing 8 dentists she had to face reality and we gave her much of what she wanted.

I think the most important advice is to be as honest with the patient as possible. This is why I am such a proponent and lecture

COSMETIC
DENTISTRY DEALS
WITH TOTAL FACIAL
AESTHETICS.



on Trial Smile for a Predictable Aesthetic Result. Never promise the patient anything except that you will do all your best in treating them.

Q. Globally cosmetic dentistry is dominated by Hollywood Smile style that promotes a wide, symmetrical and white smile. Now the question arises, is it wise to copy Hollywood Smile style in every smile design irrespective of patient's cultural, ethnic and oral health differences? And, should the desire based needs of the patient dominate the cosmetic treatment planning?

The basic principle in smile design is first understanding your patient's desires and then his or her needs. Although every human is different we all have common shared desires of how we want to look. This is why fashion designers can make so many of a single dress or suit that they know will be bought by consumers. The same with cars, movies and other areas of our life. And so it is with certain looks that patients want. For the past decade the

world has moved to wanting bleached white straight teeth which no doubt has been motivated by media such as movies, TV, and computer enhanced magazine ads. So, even though the principles of aesthetics that I wrote about in the first edition of *Aesthetics in Dentistry* and also in *Change Your Smile* (Quintessence) are valid, we have to constantly modify these principles to please our patients.

Q. While completing cosmetic restorative works, we generally give emphasis on micro aesthetic components such as tooth shape, size, color, surface texture, gingival aesthetics etc., and the aesthetic finishing process becomes major clinical steps. How do you see the role of force finishing in cosmetic dentistry for the long term health and success of the restoration?

One of the biggest problems I see today in cosmetic dentistry is lack of proper margin finish of both crowns and especially porcelain veneers. Since our office sees patients from all over the world who have had mul-

ONE OF THE BIGGEST PROBLEMS I SEE TODAY IN COSMETIC DENTISTRY IS LACK OF PROPER MARGIN FINISH OF BOTH CROWNS AND ESPECIALLY PORCELAIN VENEERS

tiple aesthetic failures, the most common functional cause is lack of care when it comes to both placing and finishing the margin. When I originally developed the E.T. Bur and Diamond concept of finishing restorations my concern then and still is to some degree, improper use of burs or diamonds when doing subgingival margin refinement. I was not pleased with the shape of the 7901 convex bur which could cause a concavity and therefore increase sub gingival sensitivity so I designed the ET series with a straight emergence angle mimicking just how the tooth emerges from the gingival sulcus.

The aesthetic and functional life of a composite resin restoration is in direct proportion to the preciseness of the margin finish.

Q. Certainly, we all agree the role of marginal finish in cosmetic restorations and also appreciate your various clinical articles which very well address the finishing and polishing issues. However, I would like to know your view on the role of "Force Finishing" (balancing the occlusal forces, tooth contacts sequences and its proper timing after restorations) in cosmetic dentistry. Would you kindly highlight the clinical tips you follow to manage the force components in your daily cosmetic dentistry work?

The problem of occlusion can be significant when doing aesthetic restorations but especially when porcelain occlusal surfaces are involved. First off, if you are planning to use all-ceramic crowns there will be a 'passive' fit much different than the ceramo-metal crown which has frictional fit even at the try-in stage. The exact fit of the all-ceramic restoration may not occur until the crown is bonded to place. What this means is your final occlusion may well need to be altered after the crown is finally seated. There are products which can temporarily bond the crowns to place but the film thickness may not be as thin as the final cement. So even though we try to get the occlusion perfect while the crowns are on the articulator, in the final analysis the mouth is the best articulator and be prepared to adjust the

occlusion. I stress this point because if the ceramic surfaces of any restoration are adjusted in the mouth after cementation they need to be carefully polished in order to prevent future cracking of the porcelain. The work done at NYU clearly showed that even a tiny crack can eventually become larger and larger and even resulting in catastrophic fracture.

I generally take my first occlusal record with the patient closing into centric occlusion with the bite registration material already on the teeth and abutments. My second bite registration is a 'check bite' where the patient closes in centric and then I flow the material into the teeth and abutments to later verify that the registration is correct. One of my areas of concern is to make sure the ceramist has not built in any balancing interferences, so easy to do when forming beautiful occlusal anatomy.

My sequence at try-in is as follows:

1. Try-in each crown individually, checking the margins to make sure no overhang or ledge is present. If so these areas will be adjusted or added to in another bake.
2. Try-in the crowns as a group, carefully checking the contacts with my assistants holding the crowns in place with one of the Goldstein Hu-Friedy Composite instruments.
3. Digital X-rays are taken of the contacts to make sure the proximal margins are perfect. I have been doing this for the 50 plus years of my practice with every crown or inlay I have made. And I have even found a 'double margin' that was not detected when I removed a previous existing crown where the previous dentist even missed his deeply prepared 'second' margin. And that was just in the last week!!! So X-rays are a must for me. In the event the crowns are not held in place as a group by the tightness of the contacts, I insert them with Fit-Checker (GC) which works quite well for this purpose.

THE WORK DONE AT NYU CLEARLY SHOWED THAT EVEN A TINY CRACK CAN EVENTUALLY BECOME LARGER AND LARGER AND EVEN RESULTING IN CATASTROPHIC FRACTURE

4. Then I check the occlusion. If it involves a full arch I generally will remove a posterior segment and fit 3 or 4 teeth and compare the occlusion to the opposite side. Then I repeat the process by replacing the temporary splint and removing the temporary splint on the other side until all segments are checked for contact and occlusion. Only then do I do the aesthetic evaluation of the restorations before I return them to the laboratory for any final changes and glazing necessary.

Q. Now I would like to talk about your popular book "Change Your Smile" which has been translated in multiple languages and has impacted the practice of cosmetic dentistry globally. What made you fascinated to write such a wonderful book?

Actually it was a celebrity patient of mine... the world's first standup comedian, Phyllis Diller, who had received so much plastic surgery she became a spokesperson for facial improvement. She was not aware of the cosmetic dental procedures that could make her smile look as young as she looked and when I changed her smile she said I definitely needed to write a book to let consumers know just how good they could look by changing their smiles. But to go further back, it was how my father got me to go into dentistry because I was a journalist and he told me dentistry needed great writers and that got me to thinking I might be able to make a difference in people's lives as well.

I also wanted to help patients better understand the various aesthetic dental treatments in order for them to make more educated decisions rather than just what the dentist may do best and ignoring the various specialty options which could be critical to obtain optimal aesthetics. An important part was to put in realistic fee ranges rather than just what a magazine or even insurance company would list as the proper fee. Patients have a right to have the best functional and aesthetic treatment available and also need to understand why there are

fee ranges to obtain that best.

Q. As you know, globally young dentists are willing to focus their practice in cosmetic dentistry. But they are facing difficulties to obtain proper skill training since it is quite expensive and difficult to choose. What do you suggest to our youngster to upgrade their clinical skills and patient management in cosmetic dentistry?

One of the very best and most economical ways is to become a member of www.dentalxp.com where there are step-by-step over the shoulder videos of virtually every aesthetic procedure done by over 150 experts in every specialty. There are over 85,000 dentists worldwide who have registered to broaden their experience learning from the best in dentistry. The basic registration is free and there are so many courses, tips, and over 1000 videos available for no cost whatsoever. Even the premium membership is affordable to virtually any dentist and is much less than going to a hands on course.

Q. Full smile makeover and instant orthodontics that require aggressive tooth preparation (increased biological cost) are being marketed aggressively through media and professional dental magazines in the name of Hollywood Smile Style. The over utilization of these invasive treatment modalities are becoming one of the major ethical problems in various countries. How do you think that we can change the mind set of our dental professionals towards healthy cosmetic dentistry?

This can be a problem since media in most every country tends to highlight the celebrities in that country and for the most part, they have gone for the typical 'Hollywood smile'. Good, ethical, marketing of conservative cosmetic dentistry can and should be the objective of dental societies and dentists alike. Consumers need to know that the conservative techniques of cosmetic contouring, bleaching, and direct composite bonding can really create great smiles for so many people. And I really feel that

CONSUMERS NEED TO KNOW THAT THE CONSERVATIVE TECHNIQUES OF COSMETIC CONTOURING, BLEACHING, AND DIRECT COMPOSITE BONDING CAN REALLY CREATE GREAT SMILES FOR SO MANY PEOPLE.

orthodontics is a better option to improve the straightness of the teeth rather than cutting down teeth for full crowns. Porcelain veneers can also be a conservative option when called for especially when no or very little tooth preparation is necessary. So it is really up to dental organizations to educate the public properly rather than leave it to advertising dentists who just want to publicize what they do best.

Q. Globally few clinicians are raising voice against the aggressive and over treatment modalities in cosmetic dentistry, and now the Minimally Invasive Cosmetic Dentistry (MiCD) trend is emerging as a voice of voice less. Do you think that this mission will bring positive impact in future dentistry? And what do you suggest to these clinicians who are promoting MiCD?

I have been at the forefront of minimally invasive cosmetic dentistry during my entire career. We are taught in dental school that above all, "Do No Harm" to the patient. This means whenever possible, avoid potential damage to both gingival and pulp tissue... taking precaution and considering not only the short term improvement to a patient's smile but also considering the patient's lifetime of dental restorations. I also write for 3 consumer magazines and one of my more recent articles asked the question "Are We Over Laminating America?" No doubt the porcelain veneer restoration has been severely overused not for the patient's benefit but for the dentist's benefit in many situations. I have seen full crowns used in an entire mouth when orthodontics would have been a much better option. My fear is that these overtreatment cases will come back to haunt us in the media unless we can better educate the patient as to what will be best in his or her situation. This is also why I wrote and continue to update Change Your Smile.

Q. You were actively involved in formation of International Federation of Esthetic Dentistry (IFED) and supported a lot for its progress and development. Would you please let our reader know how IFED can support emerg-

ing cosmetic societies and academies in promoting ethical, responsible and quality cosmetic dentistry practice globally ?

I really wanted to see the International Federation of Aesthetic Dentistry formed in order to help foster worldwide understanding of the importance of aesthetic dentistry in helping to improve our patients' lives.

The very reason I birthed the idea of an academy devoted to aesthetic dentistry (The American Academy of Aesthetic Dentistry) which has led to countless organizations worldwide was to accomplish this purpose. This is and has been achieved by countries forming their own academies of aesthetic dentistry in order to better teach dentists not only the importance but also how better to master the techniques in aesthetic dentistry. The IFED has been a major help in bringing top quality speakers to various academies as well as elevating the quality of cosmetic dentistry in every country it touches. And I feel the Federation can do so much more if we can get more quality minded educators and clinical dentists to form an academy devoted to the best principles our profession has to offer.

Q. Lastly, please give the readers of this MiCD Journal the valuable practice tips for successful cosmetic dentistry.

I have created so many tips in my one on one and over the shoulder videos for DentalXP that all the reader has to do is sign up at www.dentalxp.com and partake of the various subjects and especially the ones I have done in restorative dentistry. Right now I am busy updating the 3rd edition of Aesthetics In Dentistry to be published next year by PMPH and my hope is that it will be translated just as my consumer book, Change Your Smile has in over 10 languages. ■

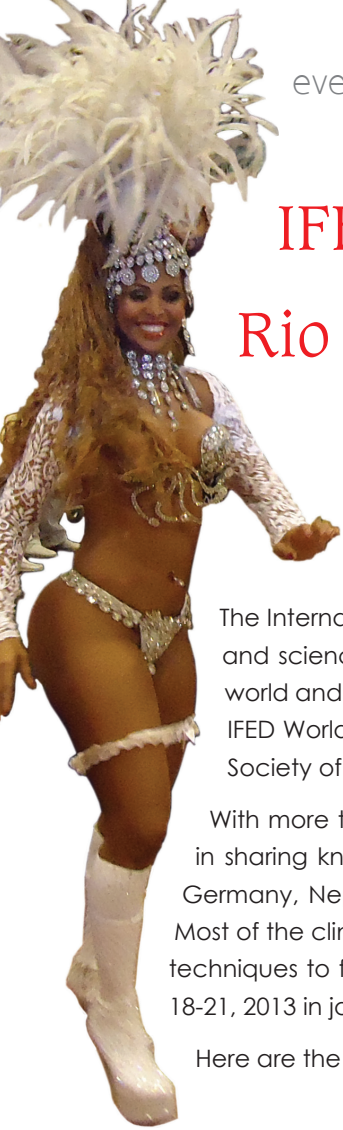
No doubt the porcelain veneer restoration has been severely overused not for the patient's benefit but for the dentist's benefit in many situations.



Jan. 26 - 31	MiCD TMJ Harmony Mini Residency, VISA, Kathmandu, Nepal
Jan. 27-28	BAAD Annual Scientific Meeting - Buckinghamshire, UK
Feb. 3-5	ARAED 1st Annual Meeting - Conrad Hotel, Cairo, Egypt. . USACHicago -General Assembly Meeting of IFED -23 .Feb
March 30-31	PASE XI Congress - Warsaw, Poland
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

event highlights

IFED 7th world congress, Rio de Janeiro, Brazil



The International Federation of Esthetic Dentistry (IFED) was established in 1990 with a mission of promoting art and science of aesthetic dentistry globally. The federation has 29 academies as members from around the world and organizes world congress on every 2nd year in collaboration with its member's academies. The 7th, IFED World Congress of IFED was organized in Rio de Janeiro beautiful city of Brazil in collaboration with the Society of Aesthetic Dentistry from Nov 2nd -5th, 2011.

With more than 1,100 registrations and delegates from all around the world, the meeting was very successful in sharing knowledge and experiences on cosmetic dentistry . There were 42 oral presentations from the UK, Germany, Nepal, Greece, Korea, Japan, Italy, Israel, Belgium, Switzerland, the USA and the host country Brazil. Most of the clinical presentations focused on restoration precision, case finishing and use of minimal intervention techniques to for healthy cosmetic dentistry. The 8th IFED world congress will be held in Munich from September 18-21, 2013 in joint collaboration with German Academy of Esthetic Dentistry (DGAZ).

Here are the event highlights of 7th IFED World Congress, held in Rio de Janeiro, Brazil





Cosmetic dentistry in philippines

Sonny H. Burias
President, PAED



The Philippines has a dynamic archipelago comprising of 7,107 islands and a total coastline longer than that of the USA, and is the perfect blend of the Oriental with the Occidental trend. The fascinating country side with its warm tropical waters, coral gardens with beautiful marine life, the thriving capital city of Manila which is an amalgam of a rich history and a rapidly developing present - is a treat to the visitor.

The overall population for the Philippines is growing, and the elderly segment of the population is growing even faster; these phenomena will increase the demand for general and aesthetic dental care. In addition, elderly people are more likely to retain their teeth than were their predecessors, so they will require much more care than in the past.

Filipinos are one of the most beauty conscious people in Asia. They especially focus on facial aesthetics and want to keep their smiles healthy and beautiful. The trend of cosmetic dentistry in Philippines is influenced by Hollywood Smile approach. With an increased media and fashion exposure, young generation in Philippines demands for whiter, wider and symmetrical smiles. Hence, cosmetic dentistry is fast becoming a highly respected profession in the Philippines. Employment of cosmetic

dentists is projected to grow by 16 percent through 2018, which is faster than average for all occupations. Recently, some private insurance providers have increased their dental coverage. If this trend continues, people with new or expanded dental insurance will be more likely to visit a dentist than in the past.

Today, the Philippines is home to some of the best cosmetic dental clinics which have international accreditation offering range of cosmetic dental treatment such as teeth whitening, veneers, inlays and crown at a fraction of the prices as compare to most of the western and European countries. In short, prices for cosmetic dentistry, restorative dentistry and dental implants in the Philippines are very competitive without compromising on the quality.

We believe, cosmetic dentistry in any country must be guided by scientific knowledge and evidence, skills and ethics. Philippines Academy of Esthetic Dentistry (PAED) therefore is working very hard to educate the public and professionals about healthy cosmetic dentistry. PAED is one of the core aesthetic academies which is promoting the mission and objectives of minimally invasive cosmetic dentistry. It has conducted the first international symposium on MiCD in 2010 in Manila. Filipinos cosmetic dentists are very aware of preserving natural tooth structure while providing cosmetic dental treatment to their patients.



MiCD-TMJ Harmony Mini Residency Program, Nepal - 2012

The MiCD TMJ-Harmony Mini Residency Program is an intensive 3 day clinical workshop specially designed to cater the progressive clinicians who desire to incorporate TMJ-Harmony Concept to harmonize teeth, muscles and joints during functional and para-functional (clenching and sleep bruxism) activities of the stomatognathic system.



Jan 26-28, 2012 Kathmandu, Nepal

Training Fee: 3500 USD (including 2 days trekking)

For Registration: info@micdeducation.com

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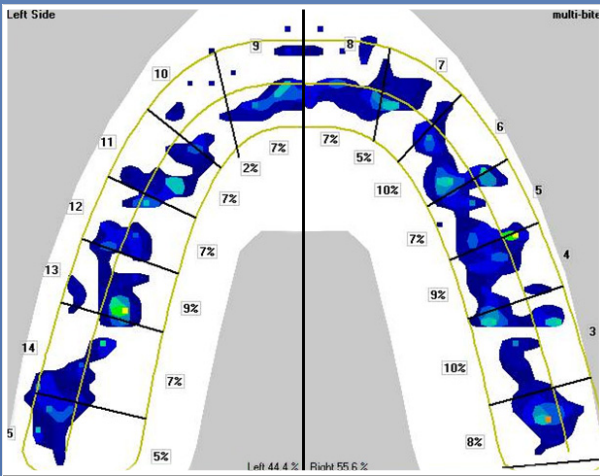
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