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The functional esthetic zone: The prominent factor in developing a pleasing smile design

By Joseph J. Massad, DDS,
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and Sam Strong, DDS

This article will detail the steps utilized to orthopedically reposition a patient's existing diminished, acquired mandibular posture and fabricate two new prostheses within the confines of the functional esthetic zone and at the same occlusal vertical dimension. Due to the patient's strong desire to have a dramatic change, both final prostheses were presented to her to select from.

Even though there may be differences on dentists' views of esthetics, the patient generally influences much of the outcome. In 1999, Vanblacon¹ cited a definition of esthetics in the Journal of Prosthetic Dentistry that is still germane today: "Esthetics objectifies beauty and attractiveness and elicits pleasure." However, we must ask: "Who is the authority on



Fig. 1: People around the world have varying perceptions of beauty.

esthetics?" (Fig. 1).

As long as we can agree that the key to esthetics lies in individual perception, the mystery is much easier to solve. The mouth is presented to the world via lips and teeth, and has long been a focus for varied opinions of what is the best appearance.

Individual perception is strongly tempered by environmental influ-

ences and contemporary societal mores and foci.²

We as dentists must also understand that the emotion of the patient plays a very real and important role in the perception of beauty.

Case presentation

A 44-year-old female presented for replacement of her existing 10-year old complete dentures



Fig. 2: Severely worn prosthetic teeth displaying an acquired Class 3 occlusal scheme.

(Fig. 2). During the assessment, the patient revealed her desire to look natural, like a "real person." She discussed her embarrassment in public as she felt inferior to her coworkers.

The patient's evaluation included an assessment of her existing prosthesis as well as her oral

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Patient appeal ratings: The science behind Web sites that work

By Frith Maier, CEO

Cosmetic dentists are clinical perfectionists. To an extraordinary degree, you take personal pride in the smiles you restore and think of the patients wearing these smiles as walking advertisements for your work. Until now, there has been a dearth of information regarding what consumers care about and how they respond to cosmetic dentists' sites. No longer.

Earlier this year at the AACD Annual Session, Sesame Communications shared the results of a breakthrough market research study that investigated how patients choose a cosmetic dentist online. In this study, participants from across the United States were recruited and screened by Resolution Research, an independent market research firm, to ensure that they were currently searching for a cosmetic dentist.

Participants were between the ages of 21 and 59, had a household income of at least \$60,000 and intended to make an appointment within 60 days.

The facilitator and the partici-

pants were connected and recorded via telephone and the Internet in one-on-one interviews. Participants were asked to think out loud as they navigated the Web sites and provide honest feedback, either positive or negative. No consideration was given to the company that designed the sites.

At the end of each session, the prospective patients completed a survey about the likelihood of them making an appointment with the cosmetic dentist whose site they evaluated. Amazingly, 80 percent of the Web sites reviewed by prospective patients failed to persuade them to make an appointment. After reviewing the results of this research, Dr. Mickey Bernstein commented, "This study reveals the mindset of today's dental patients. It deserves a long, hard look!"

Following are some specific findings regarding patient preferences and what appeals to them in a dental practice Web site. Some of the discoveries may well surprise you.

Cosmetic dentistry shoppers are different. In two previous studies commissioned by Sesame Commu-

nications, prospective general dentistry and orthodontic patients gave high scores to Web sites that conveyed a warm, personable practice. Cosmetic dentistry patients, on the other hand, are more focused on treatment options. They consistently

go straight to the procedures page of your Web site. They want to know what conditions are corrected by specific procedures, what the procedures involve, how long they take,

→ **CT** page 2B

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ANNUAL DENTAL TRIBUNE STUDY CLUB SYMPOSIA
AT THE GNYDM NOVEMBER 29 - DECEMBER 2, 2009

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The DTSC Symposia at the Greater New York Dental Meeting offer an inspiring schedule of continuing education lectures in various dental disciplines. Each scientific lecture will provide an invaluable opportunity to learn diverse aspects of dentistry and how to integrate a variety of treatment options into your practice.

We have developed a course schedule that is both diverse and engaging, and which also offers you the opportunity to earn C.E. credits. The symposia sessions are FREE for all Greater N. Y. Dental Meeting visitors, but pre-registration is recommended to ensure preferred seating.

SUNDAY
NOVEMBER 29

10:00 - 11:00 am
ONE-STEP ADHESION, ONE-STEP CEMENTATION
 Dr. George Freedman DDS

11:30 - 12:30 pm
HIGH RESOLUTION CONE BEAM WITH PREXION 3D
 Dr. Dan McEowen DDS

1:30 - 2:30 pm
SIMPLIFY ESTHETIC DENTISTRY
 Dr. Steven Weinberg DDS

3:00 - 4:00 pm
THE BEAUTY OF BONDING
 Dr. Howard Glazer DDS

TUESDAY
DECEMBER 1

10:00 - 11:00 am
TECHNOLOGICAL RESOURCES AND BIOLOGICAL CONCEPTS IN MINIMALLY INVASIVE ENDODONTICS
 Dr. Renato Leonardo DDS

11:30 - 12:30 pm
CLINICAL APPLICATIONS OF NARROW AND WIDE IMPLANTS IN IMPLANT DENTISTRY
 Dr. Gary Henkel DDS

1:30 - 2:30 pm
ESTHETICS USING COSMETIC PERIODONTAL SURGERY
 Dr. David Hoexter DMD

3:00 - 4:00 pm
YOU'VE TAKEN IMPLANT TRAINING ...WHAT DO YOU DO NEXT?
 Lynn Mortilla, RDH

MONDAY
NOVEMBER 30

10:00 - 11:00 am
E4D SKY: DENTISTRY'S DESTINATION
 Dr. Gary Severance DDS and Lee Culp CDT

11:30 - 12:30 pm
KNOW YOUR PRODUCTS & TOOLS FOR TODAY'S HEALING DENTISTRY
 Dr. Fay Goldstep DDS

1:30 - 2:30 pm
ORAVERVE™ - IN PRACTICE
 Dr. Steven Glassman DDS

3:00 - 4:00 pm
THE ADVANTAGE OF SMALL FOV HIGH RESOLUTION CBCT IMAGING
 Dr. Dan McEowen DDS

WEDNESDAY
DECEMBER 2

10:00 - 11:00 am
RESTORATION OF THE ENDODONTICALLY TREATED TOOTH
 Dr. George Freedman DDS

11:30 - 12:30 pm
IMMEDIATE TOOTH REPLACEMENT IN THE ESTHETIC ZONE
 Dr. Barry Levin DDS

1:30 - 2:30 pm
MORE THAN JUST TEETH AND GUMS
 Dr. Ron Schefdore DDS

3:00 - 4:00 pm
MY FIRST ESTHETIC IMPLANT CASE - WHY, HOW, & WHEN?
 Dr. Marius Steigmann DDS

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For more information, please contact **Julia E. Wehkamp**, C.E. Director, Dental Tribune Study Club
 Phone: (416) 907-9836, Fax: (212) 244-7185, E-mail: j.wehkamp@DTStudyClub.com

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and they want “before and after” photos.
Reality reigns. Patients want to see images of “regular people” just like them. They found sites that were overly glamorous, contained advertising images or photos of celebrities or models to be disingenuous.

Cosmetic dentistry shoppers are impatient. Anything that slows consumers down or forces them to think about where to find information is likely to send them on to another Web site. Introduction pages, flash sites with small page size, pop-up and auto-play music and video all led patients to click off.

Other factors that drove patients away were hard-to-use menus or navigation, pages with an overwhelming amount of text and “coming soon” signs.


Don't try to “sell” them. Newsletter sign-ups that pop up, promotional coupons and too many “call now!” messages turned out to be a turn-off. Participants reported that these made them feel the doctor was desperate.

Information attracts. Patients are more likely to call for an appointment when your Web site makes it easy to find answers to their questions. They want to know about the clinician's credentials and the team's commitment to ongoing education. Information about the modern technologies used in the practice impact their perception about how current you are on clinical skills. Finally, without going into specifics of fees, your Web site needs to make clear that you provide financial options.

From the findings of the Cosmetic Dentist Consumer Behavior Study emerged a Patient Appeal Rating™ that quantifies the effectiveness of cosmetic Web sites. This data-driven tool empowers you to create a custom Web site that uniquely differentiates your practice while ensuring that it will be high performance.

“Sesame's research was eye-opening.” says Dr. Corky Willhite. “The findings were specifically related to the cosmetic patients I want to attract and they used this information in the design of my new Web site. The result greatly exceeded my expectations!”

With the tough economy and increasing competition, it's important to be online and be in touch. A complete patient connection strategy needs to incorporate secure access for patients to their appointment, account and treatment information, reminders, feedback and survey mechanisms, search engine optimization and online collaboration as well as online marketing. It all starts with your Web site: building it to attract new patients and making it work 24/7 to maintain their trust.

I encourage you to download a complimentary copy of the complete whitepaper reporting on the Cosmetic Dentist Consumer Behavior Study at www.cdpatientappealrating.com/cosmetictribune. While you're there, you can request a free Patient Appeal Rating for your Web site to find out how your site ranks with prospective patients. 

Frith Maier writes and lectures frequently on how dentists can best serve their patients in a 24/7 online world. As founder and CEO of Sesame Communications, she has championed extensive market research studies on dental patient behavior to understand their communications preferences.

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Detect Oral Lesions in Stage 1 and **Save A Patient's Life**

Detroit News, September 2009

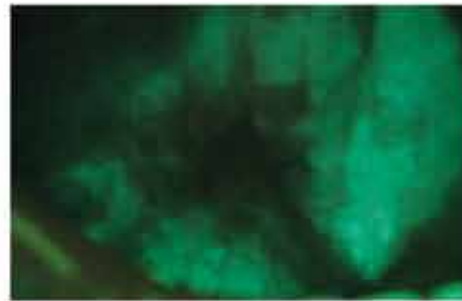
Michigan patient awarded \$15M in oral cancer suit

In 2009, it is projected that 35,000 Americans will be diagnosed with oral cancer, resulting in 7,500 deaths. In fact, failure to diagnose oral cancer is the second highest cause of dental malpractice claims.* The Oral Cancer Foundation reports that the high death rate is not because oral cancer is hard to detect or diagnose. Rather, it is because lesions are not found at an early stage.

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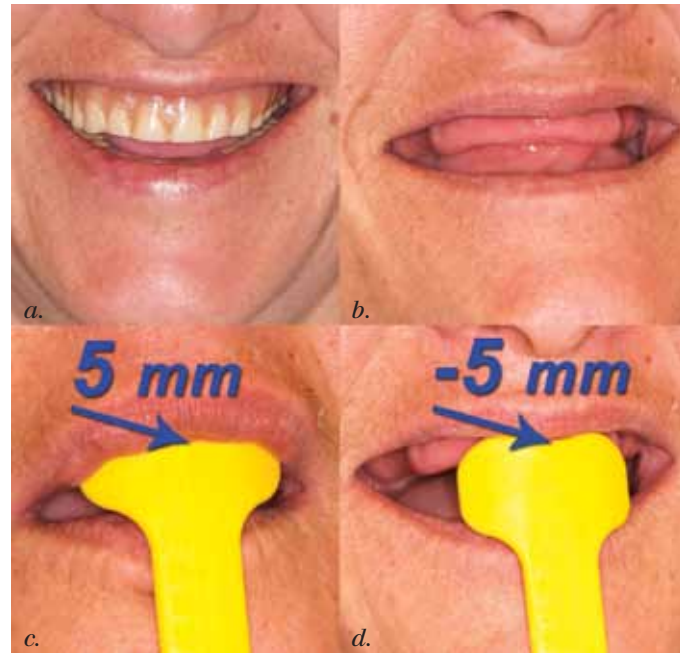
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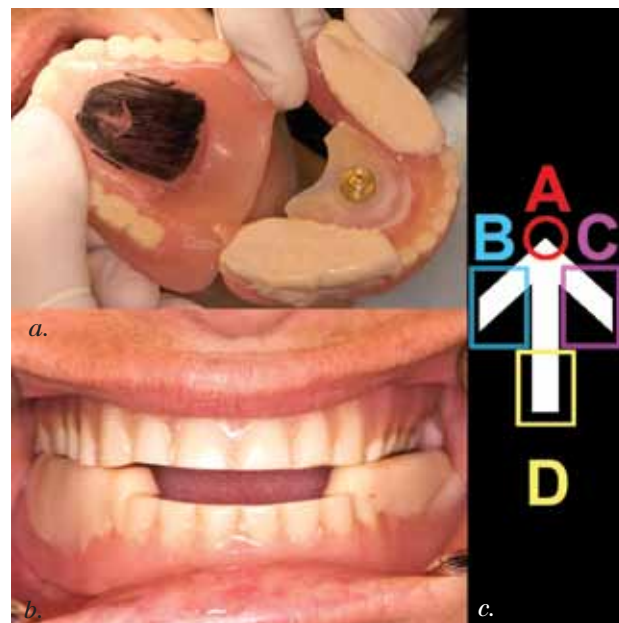
What you see may just **save lives.**

Figs. 3a, b: In 3a, note the overclosed nose-chin position. In 3b, gummy smile and flat smile line.



Figs. 4a-d: a) Gummy flat smile line; b) high smile displays excess gingival show; c) resting lip-to-ridge crest is +5 mm (measured with Massad Lip Ruler); d) high smile lip-to-ridge crest is -5 mm.

Figs. 5a, b: a) jaw recorder pin set at patient's OVD, b) compass set at patient's OVD.



Figs. 6a-c: a) Jaw recorder with cured resin splint showing tracing on upper striking plate, b) Cured splint at OVD, c) A = centric relation, B = left lateral, C = right lateral, D = protrusive

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tissues, occlusal vertical dimension, tolerance index, bone height, tissue character, tissue mobility, facial asymmetry, muscle tenacity and vertical ratio of facial mask to alveolar ridges. Our findings revealed a flat smile line and gummy display compounded with extreme loss of occlusal vertical dimension, making her face appear to be many years older (Fig. 3).

The intra-oral tissue examination revealed a mandibular anterior epulis fissuratum, which necessitated surgical excision before initiating the fabrication of any prosthesis. Of particular concern was the vertical relationship of the median alveolar ridge crest to the upper lip at repose and when smiling.⁵ A distance between 8 to 10 millimeters at repose and 4 to 5 millimeters when smiling will generally provide the practitioner adequate space (called the esthetic zone) to set prosthetic teeth.

In addition, bulky maxillary anterior alveolar ridges may also provide inadequate space for optimal prosthetic tooth positioning and proper labial flange extension without causing protrusion of the upper lip. This measurement is recorded with the esthetic lip ruler (www.GDIT.us) (Fig. 4).

Alveoplasty is often performed to reduce ridge height and bulk to accommodate the fabrication of an esthetic prosthesis. However, for this patient, alveolar ridge reduction may have adversely affected denture stability. In extreme cases, the LeFort 1 osteotomy has become a standard and predictable surgical approach⁴, but it is not a financially attractive option, especially in this depressed economic time.

With the advent of a larger range of longer necked prosthetic tooth designs, the practitioner generally achieve an acceptable result, as long as the patient is aware that there will be some gum show, but to a lesser extent than the patient's existing prosthesis. Furthermore, the prosthesis may be slightly compromised due to the lessened strength of the bond between the prosthetic teeth and the denture base.

The lip ruler can be used to measure both the upper and lower vertical measurement of the functional esthetic space (zone). This ruler has proven to be an invaluable aid when determining the distance between the premaxillary or premandibular ridges to the lips at repose and smiling, giving the practitioner the ability to properly treatment plan the final prosthesis.

In this patient, the resting upper

lip measurement was recorded as a +5 millimeters and the smiling lip measured a -5 millimeters. This was an extreme case that required special efforts to accomplish a satisfactory outcome: a minimum of 10 to 14 millimeters of prosthetic tooth height (measured from the incisal edge to the cervical neck) would be required to disguise the excessive gingival display.

Accomplishing the desired smile line with reduced gum show would mandate both the thinning of the denture base and the scalloping of the lingual surfaces of the prosthetic teeth to be able to position the teeth as close to the ridge as possible.

After proper healing of the epulis fissuratum's surgical site was observed, the patient's existing prosthesis was relined with a resilient polyethyl methacrylate material (Permasoft, Dentsply Prosthetics). This liner would allow the tissue to rebound and provide better adaptation during the fabrication time of the new prosthesis. The patient's occlusal vertical rest position was taken utilizing the exhaustive technique, and repeated several times to verify accuracy.

It is our treatment protocol to deprogram the patient's musculature from the existing acquired occlusion at the closed vertical

posture. Therefore, an occlusal splint was fabricated allowing 2 millimeters of freeway space.⁵ The splint was fabricated by mounting a central bearing device to the existing denture prosthesis.

The central bearing device was originally introduced by Hesse in 1887.⁶⁻⁸ However, it lost favor in the general dental arena due to complexities in mounting of the device and overall difficulty of use. All previous devices were constructed of metals and would not readily adapt to any irregular or reduced vertical situation.

The newer disposable, adjustable devices can be utilized not only in the edentulous, but also in the fully dentate and combination patient (jaw relation recorder, www.GDIT.us). This new recorder was designed by the lead author to improve upon all previous deficiencies in the central bearing devices, allowing for practitioner versatility.

Mounting this device to the patient's existing maxillary and mandibular prostheses allows the practitioner to adjust the vertical relationship to the desired occlusal vertical dimension (Fig. 5). The central bearing device provides equalization of occlusal pressure

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and increased denture base stability during the procedure.

Once the vertical relationship is set, ethyl methacrylate was mixed to a doughy consistency and placed on the mandibular posterior occlusal surfaces of the existing worn denture. The patient was then asked to close until the vertical pin occluded with the striking plate, and then slide her jaw forward, and then back, and then side to side, and then in all directions.

The patient continued these movements until final resin polymerization was obtained. The splint was then trimmed and polished. The patient wore the occlusal splint until the completion and delivery of the new prosthesis⁹ (Figs. 6a-c).

A maxillary wax rim was fabricated utilizing the dimensions from the previous lip ruler reading. With these measurements, the prosthetic technician can fabricate the record base to the proper height to minimize the dentist's chair time. This patient's resting lip-to-ridge crest measurement was recorded to be +5 millimeters, and the wax rim was fabricated to duplicate this distance.

The esthetic rim was then placed in the patient's mouth and analyzed as to the support of the maxillary lip. Any required alterations were made at this time. The rim was then marked confirming the resting lip line. The patient was then asked to smile, and the smiling lip line was marked.

A midline position was also taken by standing directly in front of the patient and marking the center position while the patient was smiling. Once this was completed, a face bow record was made.

The completed esthetic blueprint provided the prosthetic technician with information on setting the length of the anterior teeth and the height of the cervical or apical portion of the neck of the tooth, allowing customization of the esthetic design (Fig. 7a).

The patient's functional mandibular neutral zone position was then recorded. An acrylic base plate was made and green stick compound adapted to this rim to fabricate the neutral zone base. The height of the neutral zone base was determined at the assessment appointment by utilizing the lower half of the lip ruler to measure the premandibular ridge crest to mandibular resting lip distance.

By using this measurement to form the base, the pre-fabricated base will reach the vertical height of the resting lower lip when placed in the mouth. The neutral zone base was heated in warm water until the compound softened, very much like a soft-boiled egg. Care was taken not to overheat the compound material to ensure the proper consistency.

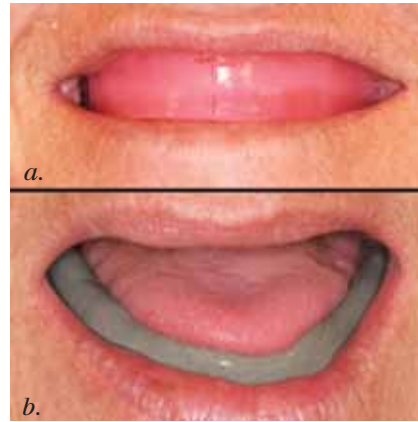
This softened neutral zone base was then placed on to the patient's mandibular ridge and the patient

was given the instruction to swallow while sipping warm water in order to stimulate the facial muscles to contract and expand.

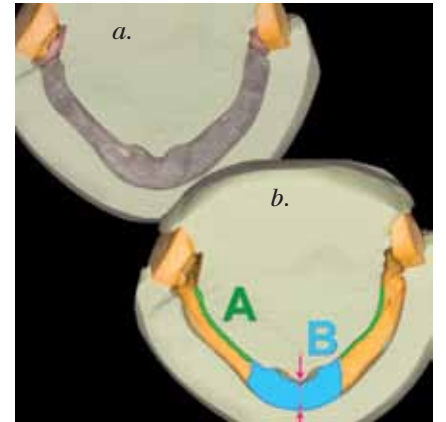
While swallowing, the lips move inward while the tip of the tongue and the lateral border of the tongue move outward. At the same time, the external facial muscles and the buccinator muscles move inward.

Every patient has different muscle tenacity, even from the left to right side of the face. Some patients have weak and flaccid muscle tone, which will generally produce a wider base record, while patients with heavy muscle tone will record a narrow base (Fig. 7b).

This record was indexed on the model with a silicone material,



Figs. 7a, b: a) Esthetic blueprint with midline, resting lip, high smile lip markings, b) Completed functional neutral zone record following lips, cheeks and tongue.



Figs. 8a, b: a) Silicone index of neutral zone record; b) A = space to set posterior teeth; B = anterior teeth to be set within space to match phonetics and esthetics.

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Fig. 9: Original prosthesis in place.



Fig. 10: New prosthesis, option No. 1.



Fig. 11: New prosthesis, option No. 2.

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thus allowing the prosthesis to be made within the confines of the functional pressures of the lips, cheeks and tongue (Fig. 8).

This neutral zone procedure dates back to the early 1900s when it was initially described by Sir Wilford Fish in the United Kingdom.¹⁰ It was later improved upon and Frank Schiesser and Victor Beresin published a method in 1974.¹¹

Studies have supported this physiological method of maintaining the actual tone of the muscles of facial expression and mastication. When recorded appropriately, patients have noted improved stability and retention of complete dentures, especially in those cases with severely resorbed mandibular alveolar ridges.

Both the esthetic blueprint record and neutral zone record combined with the face bow record were utilized in the final tooth set-up.

The final procedure was to record the patient's centric relation position using the vertical relationship of the patient's occlusal splint, which was made earlier. This occlusal splint was reevaluated on several occasions to determine the patient's acceptance.

It has been the lead author's experience that most patients who are orthopedically repositioned from a severely closed vertical posture will adapt without rebound. However, it is necessary for the practitioner to re-evaluate the patient on a weekly basis to verify the adaptation before final occlusal records are made.

Once the patient indicated that she was comfortable with the improved vertical dimension, this relationship was transferred with the use of base plates mounted with the jaw-recording device. The same central bearing device was placed on a set of maxillary and mandibular stabilized base plates made from the definitive impressions.

The same method of adjusting the central bearing pin to the proper vertical spacing was done to match the accepted occlusal splint spacing. The patient's protrusive, retrusive and eccentric movements were recorded.

To allow reading of the record-

ing, the striking plate against which the pin rubs was coated with an inking solution. The practitioner should be able to view the patient's jaw movements by analyzing the tracing marks.

Generally, the patient will form an arrow. The tip of the apex is considered the physiological centric relation, the side opposite the apex is considered the protrusive movement, and the left and right markings that go from the center of the apex outward to the left, and outward to the right, are considered the eccentric movements.

The tracing in this patient appeared to be consistent and repeatable.^{12,15} Many tracings will not initially show an optimal apex. This is generally the case when a patient has not been deprogrammed from a closed vertical relationship and may be experiencing TMJ symptoms. After deprogramming with a splint, the tracing will usually display a more favorable marking.

In this particular case, we utilized the patient's existing final occlusal vertical dimension from her occlusal splint because she reported that the spacing felt very comfortable after three or four days and no other areas of concern were noted. Knowing this, the same vertical dimension was transferred to the record bases and fixed into position at the apex with PVS bite registration material (Regisil, Dentsply Caulk).

Once this recording was transferred to the record bases, the practitioner had acquired all of the information that the prosthetic technician would require to position all the denture teeth in the desired relationships.

The case was then sent to the prosthetic technician with directions to set the teeth within the confines of the functional esthetic neutral zone space on the mandible and the esthetic space on the maxilla at the vertical dimension recorded.

The technician was instructed to set two different prosthetic tooth sizes and moulds and send back two wax try-ins for patient review.

In the first case, a tooth size was selected to be congruent with the patient's face. However, the tooth had reduced incisal to cervical height, which we knew would give the patient some gum show, albeit

less than in her existing prosthesis. A second set up utilized a larger mould to give the patient less gum show. Yet, it also gave the patient a more prominent horizontal position of the maxillary teeth.

Each set up was completed and placed into the patient's mouth and measured to be at the same occlusal vertical dimension with the same freeway space. Please note that in the prosthesis with the smaller mould, the patient displayed a very pleasing smile with a narrow buccal corridor. This tooth size matched the patient's smile line, however, she did have more gingival show with a high smile or when she was laughing.

The set up with the larger tooth minimized the gum show, but displayed a wider buccal corridor. Both mandibular dentures were set to the same neutral zone index. The buccal-lingual positions of the posterior teeth were set identically, however, the mandibular anterior teeth were placed to the front of the neutral zone labial-lingually, but still within the desired space.

The patient related that both mandibular dentures felt equally extremely stable. In each of the finished cases, when the patient produced an exaggerated laugh, gingival show was noted. However, in the set that was made with the larger size and mould, the gum show was minimized.

The patient was asked to test chewing different foods with each and determine any differences in efficiency. Additional food tests were performed to determine adverse food collection under or settling on the sides of the prosthesis. The patient reported that eating, food collection, speech, retention and stability were very acceptable, and it was very hard to say one was better than the other. The patient's lip posture in both cases appeared to be significantly improved over her existing prosthesis.

At the end of the day, the patient was asked to choose which prosthesis would be best for her. Please note that the function and phonetics in both the first and second prostheses were evaluated and found to have no measurable differences.

Please compare the patient's ini-

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tial prosthesis where she had a flat smile and excess gingival show with the first prosthesis and the second prosthesis. Observe each smile design.

Note how the maxillary incisal edges approximate the lower vermilion border. Compare the differences in the tooth arrangement. Compare the buccal corridor display.

Each reader can choose his or her personal preference as to beauty (Figs. 9–11). This question was asked earlier, “Who is the authority of esthetics?”

The authority of esthetics could be a mother or father, brother or sister, uncle or aunt, niece or nephew, grandmother or grandfather. It could be the mother’s daughter, it could be the husband’s wife, it could be your worst enemy. The authority of esthetics lies in the eye of the beholder.

We find that it is extremely important that we relate to our patients while the procedure is being performed and at the assessment appointment, that there will be differences between the opinions of family members, friends and the patients themselves of what is esthetic.


I ask you, the reader, which smile display would you choose? Please e-mail me from my Web site at www.joemassad.com with your answers, and I will let you know which smile design the patient chose.

Conclusion

I hope this article has given a perspective of how we assess a patient, especially for those who have a compromised esthetic space, in order to set prosthetic teeth in such a fashion as to match a functional esthetic zone.

This article also demonstrates that a patient with a severely closed occlusal vertical dimension can be orthopedically repositioned to a comfortable and repeatable vertical dimension.

The splint therapy will act to deprogram the patient’s musculature from the acquired, worn down occlusal vertical dimension and provide feedback before completion of the final prosthesis.

If a patient is motivated to look better, he or she should be willing to wear a splint to allow the body to verify an appropriate stable vertical at a repeatable stable centric relation. 

To learn more about advances in the field, I encourage you to stay in contact with me via my Web site at www.JoeMassad.com or www.GDIT.us.

For other great information for you and your patients, I recommend www.DentureWearers.com, developed by Dr. Lorin Berland of Dallas.

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