Minimally invasive smile rejuvenation

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INTRODUCTION

In today's high-paced society, people want everything accomplished now. They do not want to wait. Extreme makeovers, which have been featured in the media, primed the public to search for quick-fix treatment solutions. These programs helped to educate the public about what is available in appearance related treatment. "Same-day implants" and "get your crown in about an hour" sound appealing but there can be tradeoffs. Often significantly more invasive procedures are performed at the expense of more conservative, long lasting treatment.

We all have had patients come to the office several weeks before a significant occasion with complex restorative challenges expecting to have a quick complete smile makeover *(Fig. 1)*. Upon examination severe occlusal wear, loss of vertical dimension of occlusion and bruxism make a simple solution untenable. They often leave disappointed and seek out treatment elsewhere. Television ads extol the benefits of full mouth implants in a day, but few people realize that significant extractions are part of the treatment. Simpler may not always be better. Treatment options should be customized for what is best for the patient's overall health and well-being, not solely for expediency and convenience.

Years ago, tooth preparation was more conservative due to the use of slow speed belt-driven handpieces. With the advent of high-speed handpieces, tooth preparation could occur relatively quickly and dentists became accustomed to performing more extensive, involved and tooth altering treatments *(Fig. 2)*. Over the past 20 years there has been a shift back in health care towards more conservative treatment. Though slower and more involved for the patient and dentist, the end results and longevity may be vastly superior.

IMPORTANCE OF A SMILE

The importance of a smile cannot be overestimated. A smile is a way to communicate outwardly your feelings on the inside *(Fig. 3)*. A person with a nice smile feels more confident and open. As a result, they may be viewed as more honest and approachable. An individual with a bad smile is often greeted by others with a certain subtle elusiveness. Others do not smile back so they unconsciously learn not to smile, but rather cover their mouths or to turn away. A poor smile affects the individual as well the way they are perceived by others.

AGE FACTOR OF A SMILE

A smile affects the perceived age of the patient *(Fig. 4)*. Worn flat incisal edges are considered to make a smile look older.[1] Increased display of the mandibular teeth and decreased showing of the maxillary teeth is observed as a patient ages.[2] Collapse of the arch and a decreased filling of the buccal corridor occurs in older patients.[3] When the buccal corridor is not built out the face looks sunken in. The facial muscles are not supported. and the patient may develop lines in the face.[4] The teeth become darker with age.[5] Gums often recede resulting in black triangles where the interdental papilla does not fill in the interproximal areas cervically.[6] All these factors need to be addressed when designing a smile to give patients a more youthful smile.

CUSTOMIZED SMILE DESIGN

It is important to get to know and assess the needs and desires of a patient before beginning active treatment. The smile should fit the physical as well as psychological characteristics of the patient. "Cookie-Cutter" smiles that all look the same do not allow the true communication of the patient's inner emotions and personality. They often only display the signature look of a smile designed by the specific dentist or dental laboratory. Experienced aesthetic dentists can often see a smile and know immediately who designed and fabricated the smile.

PERSONALITY BASED SMILE DESIGN

Specific shapes, proportions and alignments of the teeth have been associated with different projected personalities.[7] The term visagism applies the prin-

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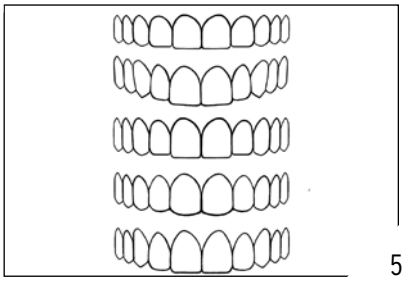
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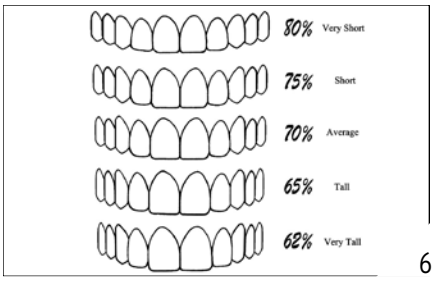

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1. Patient with worn dentition desiring a "quick fix". **2.** Full arch crown preparations. **3.** A nice smile communicates on the outside your inner feelings. **4.** Aged patient. **5.** Personality template. **6.** RED Proportion template. **7.** Pre-Op Full Face View. **8.** Pre-Op Full Smile View.

ciples of visual art to the composition of a smile.[8] It ensures harmony between the restorations and the patient's physical appearance, values, and attitudes. A template of different tooth shapes, proportions and arrangements for different personality types has been created *(Fig. 5)*. It can be placed over a photograph of the patient to help select a preferred style.

PROPORTIONAL SMILE DESIGN

The size of the teeth should coincide with the size of the face and of the whole person.[9] Generally speaking, tall people should have tall teeth and short people short teeth. The dentist preferred central incisor width/length ratio according to research has been shown to be around 78%.[10] One theory proposed as a model for proportional smile design is the RED Proportion. It states that the successive tooth to tooth width ratios as viewed from the frontal should remain constant as you move distally.[11] The RED proportion selected varies according to the size of the face and body.[12] A tall person would have a tall tooth so the width of the central incisor must also be wider to maintain the desired 78% w/l ratio. Since the central incisor is wider, the remaining space for the lateral incisor and the canine will be smaller. A tall person would use a smaller RED Proportion approaching 62% (the golden proportion), resulting in a more dominant central incisor and narrower lateral incisors and canines. Average height individuals would utilize a 70% RED proportion and shorter persons a 73-80% RED Proportion. A template of different RED Proportions has been created and can be placed over the photograph of the patient to aid in selection *(Fig. 6)*.

SMILE REJUVENATION

A 57-year-old female was not satisfied with her aging smile and wanted to look younger *(Fig. 7)*. She had a hypo-calcified area on her maxillary right central incisor which had been restored several times with direct composite restorations and needed a repair *(Fig. 8)*. She had bicuspid extraction orthodontic treatment in her youth and was dissatisfied with the affect of the missing teeth on her face and on her smile. She wanted to show more teeth when she smiled and was unhappy with the dingy color of her teeth. She was aware of the affect of esthetic dentistry upon the smile yet did not want her teeth "cut down" for crowns. She had several friends who had porcelain laminate veneers placed and wanted to have her smile to look younger and more vibrant to match her personality.

The patient was examined, radiographs taken and diagnostic casts made. A full series of photographs were exposed and evaluated *(Figs. 9-13)*. Upon evaluation a number of concerns were revealed. The shapes of the maxillary central incisors teeth were flat and the bonding on the

9. Pre-Op Retracted Smile View. **10.** Pre-Op Right Lateral Smile View. **11.** Pre-Op Left Lateral Smile View. **12.** Pre-Op Maxillary Occlusal View. **13.** Pre-Op Mandibular Occlusal View. **14.** Personality template placed over full face photo. **15.** RED Proportion template placed over full face photo. **16.** Computer Imaged Desired Final Result. **17.** Maxillary occlusal view of satisfactory position of teeth prior to removal of brackets.

right central incisor was discolored. The lateral incisors were irregular and the canine display was weak. The maxillary anterior teeth were retruded and not fully visible. The posterior teeth were too short, positioned in palatally and tipped inward. The buccal corridor was not filled and the curve of Spee was too steep. The arch was collapsed. The vertical dimension was closed and the mandibular incisors contacted the palatal gingiva.

Several options were considered including full mouth rehabilitation with opening of the vertical dimension of occlusion and full coverage crowns to lengthen and build out the facial and buccal surfaces of the teeth. The teeth could be prepared and provisionalized at an opened vertical dimension of occlusion to determine the comfort and viability of the changes and all treatment performed in three to six months. The concerns were the preparation of generally healthy tooth structure, the resulting distribution of the forces of occlusion not being parallel with the long axes of the teeth and the long-term stability.

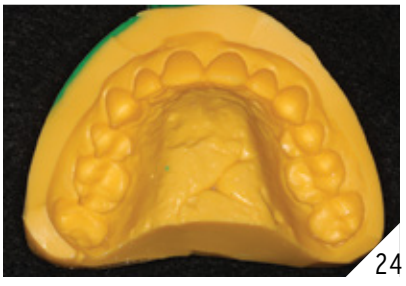
Another option was orthodontic treatment to position the teeth correctly followed by more conservative porcelain laminate veneers. The vertical dimension could be opened, the teeth moved out buccal/facially resulting in better occlusion and improved facial support and esthetics. This option allowed for minimal prosthetic treatment of the maxillary arch only. The concerns were the appearance and discomfort of orthodontics and the total treatment time of over two years.

The patient scheduled a consultation









18. Pre-ortho and completed ortho views showing tooth movement. **19.** Full Face View following orthodontic treatment. **20.** Full Smile View following orthodontic treatment. **21.** Retracted Smile View following orthodontic treatment. **22.** Tooth whitening performed. **23.** Master diagnostic model created. **24.** Putty stint to be used for fabrication of provisionals. **25.** Preparation stint to show desire position of teeth and to insure adequate tooth reduction. **26.** Photo with desired gingival contours.

with the orthodontist. Expectations and treatment schedules were discussed. The personality template *(Fig. 14)* and the RED Proportion template *(Fig. 15)* were used to help decide on the smile that would match the personality and size of the patient's smile. A computer imaged full-face photo was generated and shown to the patient to demonstrate the final treatment anticipated *(Fig. 16)*. The desired result was reviewed and the patient chose to proceed with orthodontic treatment to be followed by minimally invasive porcelain laminate veneers. Brackets were placed and the orthodontist was consulted as treatment proceeded to insure proper positioning of the teeth. The planned restorative treatment was a factor for evaluating tooth movement. Treatment time was approximately 20 months. Once the positioning was approved *(Fig. 17)*, the brackets were removed and retainers fabricated. The tooth movement was clearly visible *(Figs. 18-21)*. The arches were allowed to stabilize for six months. During this period in-office tooth whitening was performed *(Fig. 22)*.

Impressions were made along with new photographs which were sent to the dental laboratory. They prepared an esthetic "Master Diagnostic Model" which was designed to allow all to see the final desired shape and position of the teeth *(Fig. 23)*. A preparation guide was shaped on a duplicate model to illustrate the appropriate tooth preparations necessary. A putty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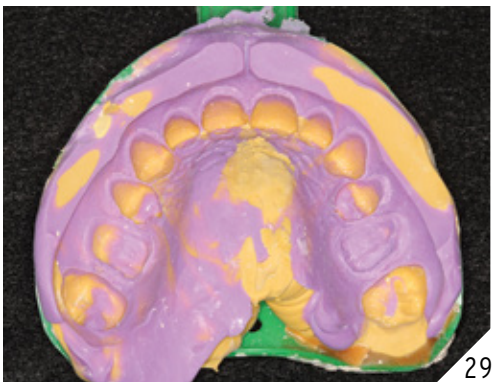
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27. Photo of desired shade tab for lab.
28. Completed tooth preparations. **29.** Final poly-vinyl siloxane impressions. **30.** Initial provisionals.

vinyl polysiloxane guide was made on the duplicate MDM model to use to fabricate the provisionals with good accuracy and facial anatomy *(Fig. 24)*. A plastic vacuum-formed plastic stint made on a duplicate of the master diagnostic model was fabricated to place over the prepared teeth to insure that adequate reduction had been performed *(Fig. 25)*.

The photographs were analyzed and the ideal gingival contours marked *(Fig. 26)*. A vacuum formed stint was made and a heat tip former used to recreate the ideal contours. The patient was anesthetized and the teeth prepared. The stint was placed over the anterior teeth and a diode laser used to contour the gingiva.

Initial photographs were taken of the desired shade tab in the same plane as the unprepared teeth *(Fig. 27)*. Photographs were taken following the initial conservative preparations to evaluate the preparations and gingival contours *(Fig. 28)*. Vinyl polysiloxane impressions were made and bite records taken *(Fig. 29)* Photographs of the prepared teeth were taken along with stump shade guides to communicate with the laboratory. The teeth were spot etched on the facial surfaces, GLUMA applied and enamel bonding agent was placed over the facial surface, light cured and bis-acryl provisional material placed in the putty matrix and seated. After two minutes the matrix was removed. The material was allowed to harden for an additional three minutes. The margins were carefully trimmed using a composite placement instrument to hold the gingival down and a very fine diamond to carefully trim the excess resin material to the preparation margins. The interproximal areas were trimmed to not impinge on the papilla. The trimmed areas were finished and polished using a finishing carbide bur and composite polishers. On the lingual surfaces an egg-shaped finishing carbide was used to carefully remove gross amounts of excess and then mounted composite finishers were used to blend the margins and not damage the tooth. Photographs were taken to evaluate the appearance and especially the incisal edge lengths (Fig. 30). Flowable composite was added to the incisal edges to improve the width/length ratio of the central incisors and match the contour of the lower lip. The patient's speech was evaluated. Protrusive and then lateral movements were evaluated and adjusted.

The patient returned to the office several days later to re-evaluate the un-anesthetized smile, cant, and comfort. Composite was added to the incisal edges *(Fig. 31)*. When satisfied, photographs were made and the alginate impressions taken to send to the lab. Photos of the desired shade tab were taken and sent to the lab.

The fabricated prostheses were carefully evaluated on the models *(Fig. 32)*. The patient was anesthetized and the


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31. Addition of flowable to indicate desired incial edges. **32.** Prostheses from dental laboratory.

right central and lateral incisor provisionals sectioned and removed. The central incisor laminate veneer was tried in to see how the length of the final restoration matched the length of the provisionals. When it was determined that the length of the final restorations were similar to the provisionals, the remaining were removed. The surface that was spot etched prior to seating the provisionals was prepared to remove any residual resin and the entire facial surfaces of the teeth were lightly touched with a small very fine diamond bur in a high-speed handpiece with water spray taking care to avoid the margins. Each laminate and crown was tried in individually to evaluate fit. Then all were tried in together. The incisal plane, curve of Spee and buccal corridor were evaluated. The patient was asked to observe the restorations in the mirror and approved. Different try-in pastes were used to evaluate the desired color of the cement. The milky-white opaque was selected with input from the patient. The interproximal contact between the two central incisors was carefully flossed to avoid causing bleeding.

The two central incisors were cleaned internally using phosphoric acid, washed and thoroughly dried using an air only syringe to avoid water contamination and further dried using a heater. Fresh non-hydrolyzed silane was mixed and placed on the intaglio surface. Three minutes later the surfaces were air syringe and heat dried. A mylar strip was placed around the distal surfaces of the central incisors and the tooth enamel was etched with phosphoric acid for 20 seconds. Any exposed dentin was etched for five to 10 seconds. Then the tooth surface was washed and excess moisture removed. Any exposed dentin was irrigated with Chlorhexidine for 30 seconds. A light cured universal dentin bonding agent was placed over the surfaces and scrubbed for 30 seconds. An air-only syringe was used to evaporate the solvent and the teeth were light cured for 20 seconds. The mylar was removed.

The laminates were coated with the light-cured resin cement. When using white opaque resin cements it is important to make sure that all the inside surface is covered and that the veneer is seated straight down to avoid any voids which would be visible. Both were placed and then each carefully held and spot cured using a 3mm light tip. A micro brush was carefully painted along the margins to remove excess cement. A curing light was waved across the laminates to make the remaining cement reach a gel state so that it can be more easily pealed away using a scaler and floss. The cement is very painstakingly cleaned and removed. Glycerin is placed along the margins and LED lights used on the facial and lingual surfaces of the teeth for three to 20 second cures while air is blown on the teeth for cooling. The teeth are washed and dried to make any excess cement visible, especially in the interproximal areas. This process was repeated for each adjacent pair. The right lateral incisor and canine, the left lateral and canine, the bicuspids and finally the two crowns were seated. The crowns were seated using a self curing two bottle universal adhesive dentin bonding agent and dual curing adhesive resin cement. If light cured universal dentin bonding agents are used they must be very thoroughly cured prior to placing the adhesive resin cement. Once all are seated, all the surfaces are dried and re-evaluated for any excess cement. The contacts are rechecked.

A crucial component for longevity is the evaluation and adjustment of protrusive and excursive movements. First the adjustment of the occlusion in maximum intercuspation is made using a very fine diamond bur in a high-speed handpiece. Then straight protrusive movements are adjusted. If the incisal edges of the maxillary and mandibular teeth are uneven, decisions have to be made as to which surfaces should be adjusted. Often the mandibular teeth are adjusted to preserve the ideal aesthetic appearance of the maxillary incisal edges. Next a combination of an initial protrusive movement followed by a lateral movement is evaluated. Often interferences exist between lengthened maxillary lateral incisors and mandibular canines. Finally, cuspid disclusion is adjusted. In the case of laminates sometimes the excursive contacts are spread out over the canine and first premolar. Photographs were taken and evaluated to see if there were any changes that need to be made. The patient was

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33. Immediate full smile view. **34.** Post-Operative full face view.

handed a mirror and their opinion asked. The length of the central incisors and the canines should be the same. The junction between the restoration and the tooth on the lingual were smoothed and all adjusted surfaces finished and polished first using a white stone, followed by a series of coated abrasives. Lastly, photographs were retaken *(Fig. 33)*.

The patient was rescheduled for a follow up appointment two weeks later. Photographs were taken and evaluated *(Fig. 34)*. The patient was asked for their input and occlusion was carefully rechecked. She was thrilled with the results and pleased that she had taken the more conservative and comprehensive treatment option. Impressions are often made for protective bite appliances.

CONCLUSION

A nice smile significantly impacts lives and can make people look and feel younger. It can dramatically improve the physical and emotional well being of patients. Newer simpler computer software allows the dentist and dental team to easily simulate in a few minutes the visual possibilities of a new youthful smile. We owe it to our patients to explore and demonstrate the potential results offered with elective aesthetic procedures.

Our patients are counting on excellent results in every case, *especially theirs*. The dentist must insure through thorough comprehensive evaluation, effective communication, proper planning, skillful expertise, attention to detail and artful execution that the final results are outstanding. By preserving as much of the integrity of critical tooth structure as possible, dentists insure the long-term biologic health of the smile and mouth.

Oral Health welcomes this original article.

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