

Personalized Digital Smile Design for Predictable Aesthetic Results

SUMMARY

Nowadays in the aesthetic dentistry concepts, techniques, and materials which aim is to establish new smiles with minimally invasive approaches and maximum natural effect on the restorations and in the same time to restore the mastication and phonetics for a better quality of life are used. However, the patient's demands and the level of information has driven the profession to a certain questioning respecting the treatment customization especially those related to treatment planning according to the individual psychological characteristics of each patient, that if ignored, may lead to esthetically dissatisfaction, even though all the esthetic rules which tend to establish standards were incorporated.

The purpose of this article is to show that besides the esthetic rules established throughout the time, the emotional expression of the treatment, represented by the shapes and lines constituent of a smile, should also be taken into consideration during the treatment planning. Softwares for personalized smile design could be powerful tool for planning such new smile designs.

Key words: Digital Smile Design, Visagism, Personalized Design, Porcelain Veneers

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CASE REPORT (CR)

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Introduction

For achieving an optimal aesthetic result of the dental treatment, we need to create a suitable smile design¹. It is extremely important to correctly diagnose teeth proportions before an irreversible restorative dental procedure is done².

By creating a smile design we are building a conception of perception by which we are trying to satisfy the patients' perception for esthetic. Unfortunately, the concept we recommend often differs from the expectations of the patient which can cause unexpected obstacles in realizing the treatment plan. The attempts to create the individual dental composition in accordance with the requirements and expectations of the patient may be in a conflict with the hypothesis that standardized esthetic conceptions of beauty inculcated in literature³.

The concept of "visagism" may help the dentists to do restorations that correspond not only to the esthetic but also to the psychological features of the created image which affects the emotions, identity,

behavior and confidence of the patient. On the other side, these factors affect the way the patients react to the definite treatment⁴.

These concepts recently have been applied in software such as "Visagismile" which can help clinicians to change the smile design.

Case Report

Twenty-eight-year old woman came to the office with a request to change the look of her smile. The main concern of the patient was the position of the rotated and inclined lateral upper incisors. Several photographs were taken to be used as a guideline through the treatment plan.

Full face picture with maximum smile and visible dentition along with intraoral pictures were taken (Fig. 1-5) to be used for digital analysis. Impressions of upper and lower jaw and bite registration were taken also for study models and wax-up technique.



Figure 1. Preoperative full face picture with maximum smile



Figure 2. Extraoral frontal view before treatment



Figure 3. Extraoral right view before treatment



Figure 4. Extraoral left view before treatment



Figure 5. Intraoral view of upper teeth before treatment

Besides analysis of patient's smile and dentition, several additional factors were taken into consideration. The axis of the central incisors was inclined slightly distally. The space between the incisors and canines was narrow and not enough for positioning of a lateral incisor with normal shape and proportions. Slight rotation of canine and inclination of the first premolar from the right side were observed. The level of the gingival margin in the front teeth was harmonious and normally positioned.

The objective of the treatment was to achieve a natural look and pleasing smile which fulfils not only the aesthetic requirements, but also emphasizes the identity of the patient. The main aesthetic challenge of this case was to achieve the proper shape and proportions of the anterior teeth and to stay minimally invasive and conservative⁵.

Digital planning and diagnostic wax-up

In order to create a personalized smile design, we used the "visagism" concept^{4,6}. Visagism in aesthetic dentistry is associated with assessment of the facial type, which involves subjective judgment, time consuming personality test and also complex calculations of the teeth configuration. We used the "Visagismile" software. It is an application which eliminates the subjective judgment, automates all the calculations and visualizes in the final result – the optimal teeth configuration.

Two main photographs were needed: one full-face with maximal smile and visible teeth and the other photograph of the upper jaw with retracted lips and black contrasting tool. The photograph in full-face with maximal smile was uploaded in "Visagismile" software and automatically placed behind the facial frame. By marking the landmark points on the image, the software analyzed the face structure and calculated the proportion of strong, dynamic, sensitive and calm face expression (Fig. 6).

The optimal tooth shape was determined by an interview (questionnaire in the software). Based on the data from the interview, a software algorithm automatically calculates the temperament, as perceived by the patient. The temperament is a combination of strong, dynamic, delicate and calm. Combination of tooth shapes conformed to individual characteristics of the patient are: strong (rectangle), dynamic (triangle), sensitive (circle), calm (square) (Fig. 7)⁷.

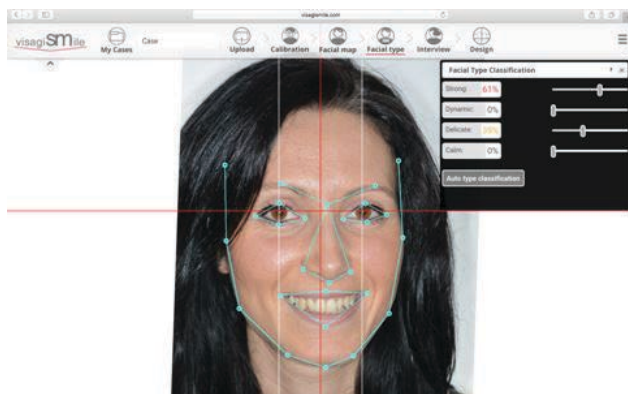


Figure 6. Facial map with landmark points and type classification

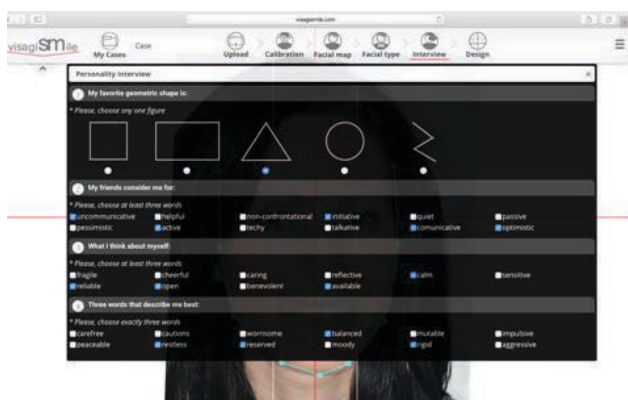


Figure 7. Personality interview

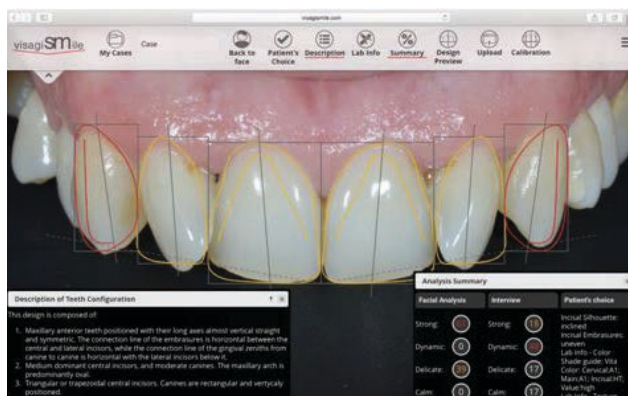


Figure 8. Final design with detailed analysis summary

The patient was also asked to provide her preferences about the desired teeth design which was also included in the calculation of the optimal teeth configuration. The preferences include characteristics of the teeth related to their color, texture and shape.

According to the face reading, the software calculated main parameters of the individual smile frame: the incisal projection, the tooth inclination and the dominance⁸. The integration was determined by the interview, tooth shapes conformed to the personality of the patient along with the patient's choice, and finished

the construction of the new smile design in accordance with the psychodontofacial harmony of the personality (Fig. 8).

The received data were exported in PDF or PNG file containing both graphic image of generated design and detailed information of sizes, correlations, inclines and shapes of teeth and the whole composition and sent to the dental technician to make a diagnostic wax-up according to those references.

Guided preparation

The main challenge in this case was to expand the arch so the space for the normal and proportional laterals could be released. By adding the volume on the central incisor and positioning them more vestibular we could expand the arch and be minimally invasive (Fig. 9 & 10).



Figure 9. Diagnostic wax up (frontal view)



Figure 10. Diagnostic wax up (occlusal view)

The first composite mock-up was based on the diagnostic wax-up. A self-curing composite material was injected into a silicon key and inserted on the unprepared teeth (Fig. 11). This first mock-up served as a motivational and communicational tool with the patient showing and explaining all the changes that can be made as the desired final outcome^{5,9,10}. New full-face and intraoral pictures were made and all the changes were discussed with the patient by comparing the relevant before and after mock-up pictures. After the patient acceptance of the treatment, subsequent steps were planned.



Figure 11. First mock up

The treatment started with the placement of a second mock which served as a prosthetic preparation guide^{11,12}. The wax-up design allowed us to do the preparations almost entirely within the enamel¹³. Burs with 1.2 mm diameter were used for the initial preparations. By cutting furrows with the depth of 0.6 mm (one half of the diameter of the bur), controlled withdrawal of the mock-up was performed (Fig. 12 & 13).



Figure 12. Preparation through the mock up



Figure 13. Preserved enamel after removing the mock up

After the initial preparation was completed, a single cord was placed and overall light chamfer reduction was made. The entire enamel was preserved during the preparation. The shallow chamfers were created slightly supragingivally. At the interproximal areas, the margins of the laterals were defined beyond the contact points to create a proper emergency profile of the future restorations. The preparations were finished with polishing discs and silicon rubbers (Fig. 14). After that, one stage PVS impression was taken and sent to the technician together with the description of the design from "Visagismile" software.



Figure 14. Finished preparations

Provisional restorations were made chair-side with the same silicon key and the composite material used for the mock-up without any adhesive procedure. Four pressed lithium disilicate veneers were fabricated in the laboratory. During the fabrication of the restorations, the shape and proportions were determined by a silicon key made from the accepted wax-up.

The final porcelain veneers were bonded on the central and lateral incisors according to the usual protocol. The restorations were adapted almost invisible to the adjacent natural teeth. The function and phonetics were undisturbed. The integration of the restorations according to the face, smile frame and the patient expectations were overwhelming (Fig. 15-19).



Figure 15. Extraoral view after the treatment



Figure 16. Accurate smile frame position of the new veneers (frontal view)



Figure 17. Extraoral right view after the treatment



Figure 18. Extraoral left view after the treatment



Figure 19. Perfect marginal adaptation and gingival support of the veneers

Discussion

The position, shape, proportions and the color of the maxillary frontal teeth are of significant importance for the esthetic result of the dental treatment. The determination of the teeth shape according to the temperament was firstly proposed by White in 1884¹⁴. The theory lost its popularity without undisputed scientific proofs in 1914. Williams proposed the so-called “low of

harmony” according to which there was a high correlation between the shape of the face and the shape of maxillary incisors¹⁵. This theory also lost its topicality nowadays, as many studies proved that such correlation is irrelevant and did not exist^{7, 16-21}.

Later Frush and Fisher have created “Dentogenic theory” which describes the relation of the face with the teeth paying attention to the sex and other personal characteristics²². The theory has been disproved quickly which highlighted the complexity of choice of appropriate tooth shapes in a dentofacial harmony^{19,23}.

Collecting diagnostic information from questionnaires or checklists may not be an appropriate method. In most cases incorrectly interpretation may mislead the clinicians in building the final design³. It is difficult for patients to define the desired tooth shape considering only an isolated scheme or picture. The clinicians build their notions based on the environment and choose the most probable result as it is the easiest to be imagined²⁴.

The digital smile design is a tool which can significantly improve the visual communication with the patient and achieve predictable clinical results⁹. There are different techniques for building the digital smile design based on the main esthetic principals and rules. However, the final esthetic result of the treatment could not satisfy the expectations of the patient because of disharmony between the smile design and the patient’s personality⁴.

The “Visagismile” software has been created by combining the principles of visagism and based on own mathematical and statistical proven laws. Combination of patient’s individuality and temperament with the objective characteristics of his/her face are the main principles of the conception for the creation of personalized smile design.

Conclusion

Current esthetic software such is Visagismile can help the clinicians to provide new smile design that affects patient’s emotions, sense of identity, behavior, and self-esteem. Combining the modern digital technologies with the classic treatment rules can be used to achieve predictable esthetic results.

References

1. Chu St. A Biometric Approach To Predictable Treatment Of Clinical Crown Discrepancies. *Pract Proced Aesthet Dent*, 2007; 19:401-409.
2. Lombard R. The principles of visual perception and the clinical application to denture aesthetics. *J Prosthet Dent*, 1973; 29:358-382.

3. Brisman A, Esthetics: a comparison of dentists' and patients' concepts. *JADA*, 1980; 100:345-52.
4. Paolucci B, Calamita M, Coachman Ch, Gurel G, Shaider A, Hallawell Ph. Visagism: The art of dental composition. *Quintess Dent Technol* 2012; 35:187-201.
5. Feraru M, Bichacho N, Muzella V. Individualizing a smile makeover. Current strategies for predictable results. *J Cosmet Dent*, 2016; 32:109-119.
6. Hallawell P. Visagismo: Harmoniae Estética. São Paulo: Senac, 2003.
7. Wolfrat S, Menzel H, Kern M. Inability to relate tooth form to face shapes and gender. *J Oral Sci*, 2004; 112:471-476.
8. Iliev G, Pavlova J, Filtchev D, Rangelov S, Kocheva B, Dimova M, Nasif-Macci S, Filchev A. Types of dominance in frontal teeth in natural permanent dentition. *Dent Med*, 2015; 97:122-132.
9. Coachman Ch, Calamita MC. Digital Smile Design: A Tool for Treatment Planning and Communication in Esthetic Dentistry. *Quintess Dent Technol*, 2012; 35:103-111.
10. Gurel G, Bichacho N. Permanent diagnostic provisional restorations for predictable results when redesigning the smile. *Pract Proced Aesthet Dent*, 2006; 18:281-286.
11. Gurel G. The Science & Art of Laminate Veneers. Quintess, 2005.
12. Gurel G, Morimoto S, Calamita MA, Coachman C, Sesma N. Clinical Performance of Porcelain Laminate Veneers: Outcomes of the Aesthetic Pre-evaluative Temporary (APT) Technique. *Int J Periodont Rest Dent*, 2012; 32:625-635.
13. Gurel G, Marcelo N, Calamita M, Coachman C, Morimoto S. Influence of Enamel Preservation on Failure Rates of Porcelain Laminate Veneers. *Int J Periodont Rest Dent*, 2013; 33:30-39.
14. White J. Temperament in relation to the teeth. *Dent Cosmos*, 1884; 26:113-120.
15. Williams J. A new classification of human teeth with special reference to a new system of artificial teeth. *Dent Cosmos*, 1914; 52:627-628.
16. Baratieri L. Study of morpho-dimentional relationship. *QDT*, 2012; 35:173-185.
17. Chu Jon L, Morante D, Bernabe E, Vich V, Cotrina L. Esthetic perception towards different combinations of facial contours and upper incisor shape. *Braz J Oral Sci*, 2009; 8:193-196.
18. Farias F, Ennes J, Zorzatto, J. Aesthetic Value of the Relationship between the Shapes of the Face and Permanent Upper Central Incisor. *Int J Dent*, 2010; 2010: Article ID 561957:6.
19. Lindemann H, Knauer C, Pfeiffer P. Morphometric relationship between tooth and face shapes. *J Oral Rehabil*. 2004;31, (10): 972-978.
20. Pedrosa VO, França FMG, Flório FM, Basting RT. Study of the morpho-dimensional relationship between the maxillary central incisors and the face. *Braz Oral Res*, 2011; 25: 210-216.
21. Peixoto Silva F, Freitas de Almedia N, Ferreira D, Mesquita M, Negreiros W. Digitized study of the correlation between the face and tooth shapes in young adult individuals. *Braz J Oral Sci*, 2007; 6:1383-1386
22. Frush JP, Fisher RD. How dentogenic restorations interpret the sex factor. *The J Prosthet Dent*, 1956; 6:160-172.
23. Sellen P, Phila B, Jagger D, Harrison A. Computer-generated study of the correlation between tooth, face, arch forms, and palatal contour. *J Prosthet Dent*, 1998; 80:163-171.
24. Lent R. One Hundred Billion Neurons: Basic Concepts of Neuroscience. 1st edition. Sao Paulo, Brazil: Atheneu, 2004.

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