Review Article

Role of digitalization in smile designing: A review

Kalyani Deshmukh[1], Usha Radke[1], Saee Deshmukh[1], Neelam Pande[1], Tushar Mowade[1], Twinkle Hatmode[1]

[1]Department of Prosthodontics, VSPM DCRC, Nagpur, Maharashtra, India.

ABSTRACT

An attractive smile makes the appearance even more pleasing. The advent in the materials and technology in the field of esthetic and restorative dentistry, along with the increased awareness and esthetic demands of the society, smile designing has gained a lot of importance. Instead of traditionally proceeding with the treatment of such cases, digitalization not only aids in simplifying the treatment but also helps in better patient communication and acceptance by elevating their participation in the treatment plan proposed.

Keywords: Digital smile designing, Esthetics, Digitalization, Rehabilitation

INTRODUCTION

One of the most important social bonding gestures is an attractive smile. It also aids in professional enhancement. Recent advances in materials and techniques of dental material sciences have led to progressive changes in esthetic dentistry. It has also led to transformation of ideas of smile and its components. To achieve the most similar outcome to the planned treatment a systematic approach to diagnosis, treatment planning and its implementation are of prime importance.[1] The early stage designing of the treatment plan aids in a more predictable and consistent outcomes. The data must guide the succeeding phases of the rehabilitation, scientifically integrating all of the patient's needs and desires and the patient's functional, structural, and biological issues into the esthetic treatment design.[2] The data serve as a frame of reference for the treatment that will be performed. Digital smile design in this regard has transformed retrospective excuses into prospective explanations. The incorporation of protocols and checklists for quality control and information management has helped to guarantee that every critical point is performed effectively, is double-checked, and is communicated correctly.[3,4]

Prosthodontists deal with the cases, wherein full-mouth rehabilitation is required to restore the patients' esthetic and functional efficiency. The cases which present with disturbed plane due to long-standing edentulism or excessive attrition require plane correction. This is often associated with consideration esthetic rehabilitation. Encorporation of smile designing has been proved to be of great use in such cases giving more esthetically acceptable appearance.[5]

Traditional approach to esthetically designing a smile included use of laminate veneers. The steps included taking thorough case history, making a diagnostic impression, and mounting with face-bow transfer and radiographs include intraoral periapical radiograph and orthopantomogram. A well-adapted and horizontally sectioned silicon matrix made from the diagnostic cast is used as a reference for teeth reduction. After teeth preparation using depth cut burs, a full-arch impression is made with rubber base impression materials. Shade selection is done with Vita shade guide (3D Master). The porcelain laminate is processed in the laboratory using either platinum foil technique or refractory die technique. Another conventional approach is two-dimensional smile designs. Here, patient's photographs are placed in MAC Keynote or PowerPoint and a digital two-dimensional designing can be done using the software available in the market. This software allows dentists to design new smiles using a simple 2D facial smile photo and intelligent teeth silhouettes. To take care of gingival or pink esthetics, the conventional means was to use manual gingival contouring with scalpel and blade.[6,7]

GOALS OF SMILE DESIGNING

The goal of an esthetic makeover is to develop a peaceful and stable masticatory system, where the teeth, tissues, muscles, skeletal structures, and joints all function in harmony (Peter Dawson). It is very important that when

planning treatment for esthetics cases, smile design cannot be isolated from a comprehensive approach to patient care. Achieving a successful, healthy and functional result requires an understanding of the interrelationship among all the supporting oral structures, including the muscles, bones, joints, gingival tissues, and occlusion.[7]
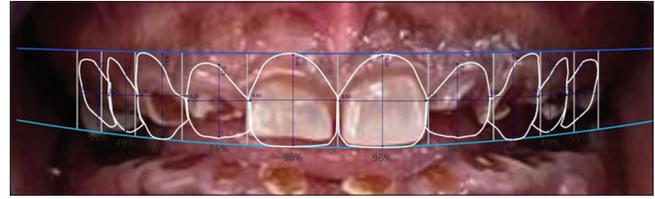
Challenges often faced by a dentist in cases requiring esthetic restorative treatment include lack of bonding efficiency due to lack of sound enamel or dentin in patients presenting with amelogenesis or dentinogenesis imperfecta, respectively.[8]

Amelogenesis imperfecta (AI) is a genetic disease caused by mutation of the genes involved in the presecretory, secretory, and maturation stages of enamel formation.[9,10] The mutation can affect both the primary and permanent dentitions and can be passed on from parents to children or develop in individuals with no family history.[9,10] Depending on the gene involved and the timing when the disruption occurs, AI produces a wide range of enamel alterations ranging from superficial discoloration to complete enamel agenesis. Based on the phenotype of the enamel alteration, AI is classified as type I hypoplastic, type II hypomatured, type III hypocalcified, and type IV hypomatured-hypoplastic.[11,12]
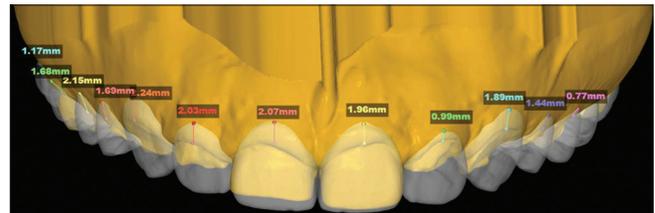
Although AI is primarily an enamel disease, not enamel-related disorders are frequently reported such as pulpal calcifications, delayed tooth eruption, congenital missing teeth, root resorption, open bite, negative overjet, and altered vertical jaw relationship.[13,14] On account of the diverse clinical manifestations, the successful treatment of AI patients requires a multidisciplinary team including a pediatric dentist, a restorative dentist, a prosthodontist, an orthodontist, and a maxillofacial surgeon.[15] The treatment always starts with restoration of the involved dentition, and minimally invasive restoration with direct composite is highly recommended due to the young age of many AI patients. However, a direct composite does not perform well in AI patients and clinical studies reveal limited longevity and high failure rate, especially in AI type II and type III, where the enamel qualitative alterations produce suboptimal etching pattern and impaired bond strength.

Digital smile designing can aid in planning these cases meticulously with minimum invasive restorative procedures. The procedures required can be made guided for optimal outcome with reduced patient trauma and better outcome. The planning can be completely done on the software and changes, if required can be made after motivational wax-up try-in. This aids in better patient compliance and more involvement of patient in treatment planning. The models can be 3D-printed and even crown lengthening procedures can be made gui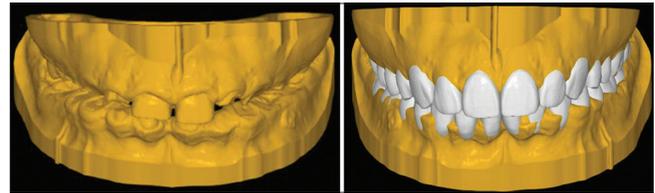ded by printing the guide which is 3D-planned. The patients reporting with a disturbed plane of occlusion often require esthetic and functional rehabilitation. Often these cases present with alveolar decompensation and planning a required plane of occlusion can often require

Digital soft tissue planning

Digital planning of crown lengthening required

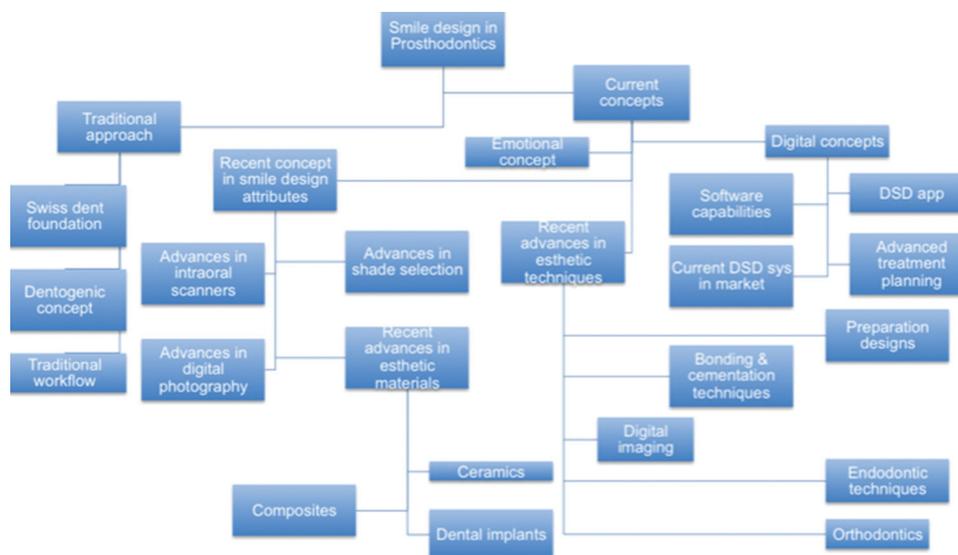Virtually mounted casts and wax mock up

Before and after pictures of the patient according to the proposed plan

extraction, implant placement, crown lengthening, and bone reduction. Planning such cases through DSD can help plan the required bone reduction and implant position. Moreover, guides can be printed for enhancing the required outcome of the planned treatment.

DISCUSSION

An attractive smile can be an enormous asset to one's personality. The facial, gingival, and dental components can

be manipulated to design a beautiful smile. The color, shape, proportion, and position of the teeth can be worked with to create a pleasing smile. The gingival architecture can also be altered. An appropriate white and pink esthetic balance is the solution in smile designing.

The goal of an esthetic rehabilitation is to develop a stable masticatory system, where the teeth, supporting structures, and joints all function in harmony.

Digital smile designing can be put to use as an instrument which aids in better communication with the patient as the proposed treatment plan can be projected to the patient with pictures in all the possible views. The integration of diagnosis, treatment planning, and execution of the same can be successfully done with the help of such software which marks a new milestone in the field of esthetic dentistry.[16,17]

Full-frame digital images are required, which include images of full face with a wide smile, full face at rest, and retracted view of the full maxillary arch with teeth apart; and videos of the patient. The video should be recorded in dynamic phases including speech and smile. This digital data will aid in planning the required treatment on a digital platform and so importing the images form the integral part of treatment. The planned treatment can then be subjected to critical evaluation before even starting the case. Wherein wax-up, digital and analog diagnosis, provisional and definitive prosthesis can be planned.

Facial and esthetic analysis is carefully done keeping the pink and the white esthetic scores in consideration. Golden proportion and recurring esthetic dental proportion are also applied while designing the contour, height, and form of the prosthesis.

CONCLUSION

Severely compromised dentition requires meticulous planning to have the desired and conservative treatment outcome. Young patients suffering from distorted occlusal plane and teeth due to various diseases such as amelogenesis and dentinogenesis imperfecta require special consideration. The use of digitalization in such cases is highly recommended as planning and execution of the treatment plan becomes more relatable and also aids in better communication with the patient.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

Author Dr. Usha Radke, Dr. Saee Deshmukh and Dr. Neelam Pande are on the Editorial Board of the journal.

REFERENCES

1. Coachman C, Calamita MA. Virtual esthetic smile design: Driving the restorative plan. J Cosmetic Dent 2014;29:1.
2. Dawson PE. Functional Occlusion: From TMJ to Smile Design. St. Louis: Mosby; 2007.
3. Spear FM. The maxillary central incisor edge: A key to esthetic and functional treatment planning. Compend Contin Educ Dent 1999;20:512-6.
4. Kois JC. Diagnostically Driven Interdisciplinary Treatment Planning. Symposium.
5. Coachman C, Van Dooren E, Gürel G, Landsberg CJ, Calamita MA, Bichacho N. Digital smile design: From digital treatment planning to clinical reality. In: Cohen M, editor. Interdisciplinary Treatment Planning, Vol. II: Comprehensive Case Studies. Hanover Park, IL: Quintessence; 2011.
6. Cervino G, Fiorillo L, Arzukanyan AV, Spagnuolo G, Cicciù M. Dental restorative digital workflow: Digital smile design from aesthetic to function. Dent J 2019;7:30.
7. Bhuvaneswaran M. Principles of smile design. J Conser Dent 2010;13:225.
8. Novelli C, Pascadopoli M, Scribante A. Restorative treatment of amelogenesis imperfecta with prefabricated composite veneers. Case Rep Dent 2021;2021:3192882.
9. Smith CE, Poulter JA, Antanaviciute A, Kirkham J, Brookes SJ, Inglehearn CF, *et al.* Amelo genesis imperfecta; genes, proteins, and pathways. Front Physiol 2017;8:435.

10. Gadhia K, McDonald S, Arkutu N, Malik K. Amelo genesis imperfecta: An introduction. Br Dent J 2012;212:377-9.

11. Witkop CJ Jr. Amelogenesis imperfecta, dentinogenesis imperfecta and dentin dysplasia revisited: Problems in classification. J Oral Pathol 1989;17:547-53.

12. Aldred MJ, Savarirayan R, Crawford PJ. Amelogenesis imperfecta: A classification and catalogue for the 21st century. Oral Dis 2003;9:19-23.

13. Koruyucu M, Bayram M, Tuna EB, Gencay K, Seymen F. Clinical findings and long-term managements of patients with amelogenesis imperfecta. Eur J Dent 2014;8:546-52.

14. Aldred MJ, Crawford PJ. Variable expression in amelogenesis imperfecta with taurodontism. J Oral Pathol 1988;17:327-33.

15. Gisler V, Enkling N, Zix J, Kim K, Kellerhoff NM, Mericske-Stern R. A multidisciplinary approach to the functional and esthetic rehabilitation of amelogenesis imperfecta and open bite deformity: A case report. J Esthet Restor Dent 2010;22:282-93.

16. Meereis C, de Souza G, Albino L, Ogliari F, Piva E, Lima GS. Digital smile design for computer-assisted esthetic rehabilitation: Two-year follow-up. Oper Dent 2015;41:E13-22.

17. Bini V. Aesthetic Digital Smile Design: Software-aided Aesthetic Dentistry-Part II. Vol. 5. CAD/CAM International Magazine of Digital Dentistry; 2015. p. 12-7.

How to cite this article: Deshmukh K, Radke U, Deshmukh S, Pande N, Mowade T, Hatmode T. Role of digitalization in smile designing: A review. J Adv Dental Pract Res 2022;1:27-30.