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Aesthetic consideration in diagnosis and treatment planning

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Dedication

.

l dedicated this project to our father's soul.

To our mother because she always fitting to grow me up

she has given us the Endless love

And opportunity of education from the best

Institutions and support throughout

Our life

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Abstract

Aesthetic considerations play a crucial role in the diagnosis and treatment planning within dental and medical practices. This paper explores the significance of aesthetics in enhancing patient satisfaction, improving self-esteem, and fostering overall wellbeing. Analyzing the interplay between functional and aesthetic outcomes, we emphasize the importance of a patient-centered approach that prioritizes individual preferences and expectations. The study outlines key factors influencing aesthetic perceptions, including facial harmony, proportion, and color matching, which are essential in crafting a comprehensive treatment plan. Additionally, we discuss the integration of digital tools and techniques in diagnostics, allowing for more accurate assessments and tailored solutions that align with patients' aesthetic goals. Ultimately, this project advocates for a holistic approach, where aesthetic considerations are systematically incorporated into clinical practice to ensure optimal treatment outcomes and elevate the standard of care in the dental field.

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Introduction

The concept of smile and dental aesthetics involves a multifaceted relationship between skeletal structures, the alveolar bone, teeth, and the surrounding soft tissues. The overall appearance of a person's smile results from the interplay among these elements (Spear and Kokich, 2007).

Esthetic dentistry has emerged as one of the most in-demand fields within dentistry, concentrating on enhancing smiles and overall appearance. Contemporary dentistry goes beyond merely repairing individual teeth; there is a growing number of patients who prioritize aesthetic results during the restoration of tooth structures (Thomas et al., 2022).

Smile design involves incorporating aesthetic principles to align facial aesthetics with the dentogingival structures. In simpler terms, it primarily focuses on the aesthetic treatment of the anterior teeth within the visible aesthetic zone. The concepts behind smile design have been developed using data from various cases, diagnostic molds, photographic evidence, scientific measurements, and essential principles of beauty (Yeşim et al., 2021).

Advancements in dental procedures, including bleaching, bonding, and veneering, have enabled the restoration and restructuring of damaged teeth while also enhancing their appearance, Smile design is typically defined as the aesthetic treatment of the anterior teeth within the visible aesthetic zone (Zimmermann and Mehl, 2015).

The goal of esthetic smile design is to create a harmonious and stable masticatory system, where teeth, tissues, muscles, skeletal structures, and joints work together effectively. Esthetic treatments should enhance the patient's appearance while maintaining a natural look that exudes liveliness and realism. A deep understanding of the interactions between muscles,

bones, joints, gingival tissues, and occlusion is essential for achieving long-lasting health and functionality in esthetic results. Additionally, smile design should be an integral component of comprehensive patient care (McLaren and Cao, 2009).

In today's digital dentistry era, virtual treatment planning is becoming a vital aspect of dental practice. Advances in computer-assisted design and computer-assisted manufacturing (CAD/CAM) for dental restorations make it possible to implement predictable interdisciplinary treatments using a backward planning approach (Zimmermann and Mehl, 2015).

The aim of this study

This study aims to assess aesthetic considerations in smile design’ focusing on the balance between teeth' gum. and facial features.

Chapter One

Review of literature

1.1 Smile design

Smile design refers to the process of crafting an aesthetic smile based on established scientific and artistic guidelines, informed by research, perception, and cultural and racial standards recognized over time. As a dynamic field, smile design is influenced by evolving trends that consider facial aesthetics, lip dynamics, the balance of pink and white aesthetics, and individual personality.

In the past, smile design primarily focused on the orodental complex. Today, modern smile designers need a comprehensive understanding of the entire patient to create the ideal smile. Subjectivity plays a critical role in smile design; purely scientific approaches may produce smiles that are generic, symmetrical, and appear artificial. Utilizing the same tooth library and gingival aesthetics for every patient often leads to unappealing results, as no two smiles are alike. Each smile must develop its unique identity based on specific guidelines.

In today's social media-driven environment, it is common for dentists to display artificial smiles. However, what truly distinguishes a beautiful smile is the incorporation of natural guidelines to attain "perfect" results. Ultimately, embracing nature and its imperfections represents the next frontier in smile design. (Graber et al., 2017)

1.2 Components of smile design

Achieving an aesthetically pleasing smile involves the seamless integration of facial and dental composition. Facial composition encompasses both the hard and soft tissues of the face, while dental composition focuses on the teeth and their relationship to the gingival tissues. For effective smile design, it is essential to evaluate and analyze both facial and dental components (Graber et al., 2017)

1.2.1 Evaluation of Facial proportions :

Facial beauty is based on standard esthetic principles that involve proper alignment, symmetry and proportion of face. Analyzing, evaluating and treatment planning for facial esthetics often involve a multidisciplinary approach which could include orthodontics, orthognathic surgery, periodontal therapy, cosmetic dentistry and plastic surgery. Thus, esthetic approach to patient care produces the best dental and facial beauty.

Attractive faces often exhibit common proportions and relationships that deviate from standard norms. In the past, treatment planning primarily emphasized linear and angular measurements. However, the current trend focuses on understanding the interrelationships of these proportions. An ideal face is typically divided vertically into equal thirds by horizontal lines that correspond to the hairline, the base of the nose, and the chin (menton). Additionally, the ideal lower third of the face includes the upper lip representing the upper third, while the lower two-thirds consist of the lower lip and chin. Increasingly, it is essential to consider not only vertical relationships but also the proportions related to facial widths, particularly the height-to-width ratio (Graber et al., 2017)

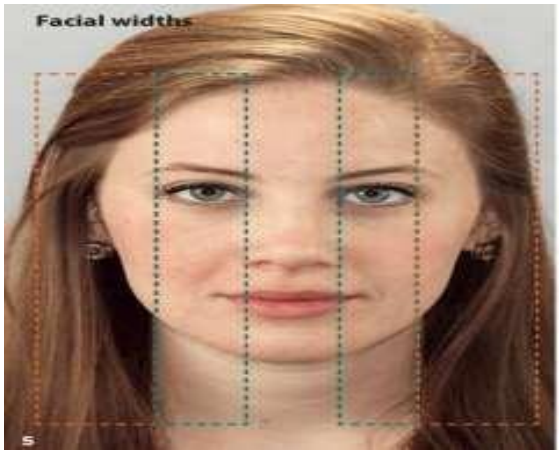

Figure (1-1): Rule of fifths (Sarver & David, 2020)

But in our clinical practice, unless and otherwise there is an obvious discrepancy in the face, we restrict our smile makeover to the dental composition only. There are two facial features which do play a major role in the smile design:

- the interpupillary line
- lips.

A– The interpupillary line:

should be perpendicular to the midline of the face and parallel to the occlusal plane. Lips are important since they create the boundaries of smile design. If we come across major discrepancies in the above-mentioned two factors, then we have to seriously consider the correction of the facial composition, before we venture into the correction of the dental composition (Bhuvaneswaran 2010)

Figure 1-2 interpupillary line

In classical terms, the horizontal and vertical dimensions for an ideal face are as follows:

- **Horizontal**:

- The width of the face should be the width of five “eyes”.
- The distance between the eyebrow and chin should be equal to the width of the face [fig2]

- **Vertical**:

- The facial height is divided into three equal parts from the fore head to the eyebrow line, from the eyebrow line to the base of the nose and from the base of the nose to the base of the chin.
- The full face is divided into two parts, eyes being the midline.
- The lower part of the face from the base of the nose to the chin is divided into two parts, the upper lip forms one-third of it and the lower lip and the chin two-thirds of it. [fig3]

The basic shape of the face when viewed from the frontal aspect can be one of the following:

1. Squar
2. Tapering
3. Square tapering
4. Ovoid

The lateral profile of an individual can be any one of the following(Fig 4):

1. Straight
2. Convex
3. Concave

These factors play a role in determining the tooth size, shape and the lateral profile; in short, the tooth morphology is dependent on the facial morphology(Bhuvaneswaran 2010) .

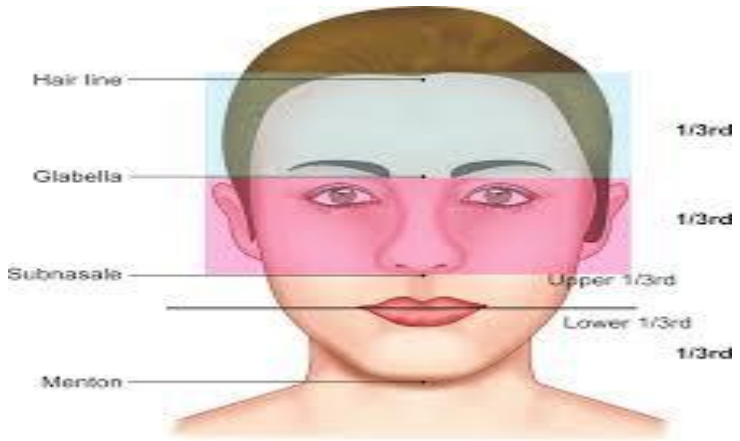

Figure1-3 horizontal dimension of face(Bhuvaneswaran 2010)

Figure1- 4 vertical dimension of face(Bhuvaneswaran 2010)

Figure 1-5 types of the face (Lubis, Lubis et al. 2018)

B - Lip

Optimal aesthetic treatment outcomes necessitate a harmonious balance between lip shape and tooth positioning. The lips frame the anterior teeth, with their size and contours influenced by inherent anatomical structures and age-related skin changes. Key diagnostic factors in orthodontics, dentofacial surgery, and aesthetic dentistry include the position of the lips and the amount of tooth and gum exposure when smiling or speaking. Research indicates that smiles showcasing all the teeth along with a slight display of gums (2–4 mm) are perceived as the most attractive (Raked. 2018).

The smile line is defined as an imaginary line that follows the incisal edges of the maxillary anterior teeth, ideally mirroring the curvature of the upper lip's border while smiling. It is important to distinguish the smile line from the lip line. The lip line refers to where the lower edge of the upper lip sits during a smile, influencing the visibility of teeth and gums at the transition between hard and soft tissues (Al-Taki et al., 2016).

Tjan et al. categorized smile lines as follows (Tjan and Miller, 1984):
- High smile line: Reveals the entire cervico-incisal length of the maxillary anterior teeth along with a band of gingiva.

Average smile line: Displays 75-100% of the maxillary anterior teeth, exposing only the interproximal gingival.

- Low smile line: Shows less than 75% of the upper anterior teeth Without any gum visibility..

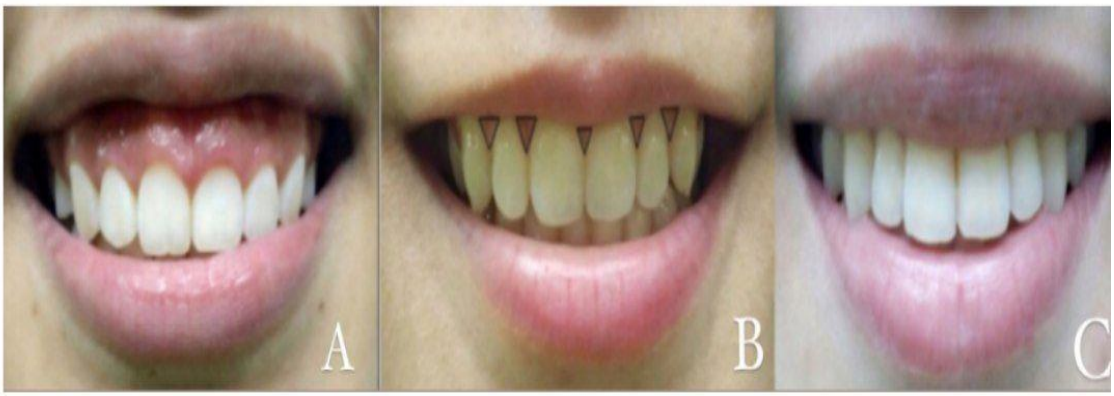

Figure 1-6 Smile line was classified according to the 3 categories: A)High smile line, B) Average smile line, C) Low smile line (Tjan and Miller, 1984)

By their display of gingiva, the lip lines can be classified in three groups - high, medium (Fig.6 a, b) and low (Fig.6 c). A low lip line covers the gingiva and a considerable portion of the anterior teeth. In such cases, it is difficult to see the

incisors when the lips are at rest. In fact, when the patient speaks, these teeth can barely be seen. The anterior teeth may be displayed when the patient is in full smile. For the teeth to be seen, it may be necessary to lengthen the crowns if the crown-root ratio and occlusion permit (Pedron and Mangano, 2018).

1.3 Dental composition

1.3.1 Dental midline:

Determining the facial midline is crucial for aesthetic interventions. related to facial asymmetry (Kai et al., 2016). Evaluations of facial symmetry and the midline can be conducted through clinical assessments, photography, cephalometry, and 3-D computed tomography. Important facial landmarks for identifying the midline include the philtrum, nasion, tips and center of the nose, and the bisector of the pupil The relationship between the dental midline and facial midline plays a significant role in aesthetic assessments (Al-Taki et al., 2016).

Midline should be parallel to the long axis of the face: the line angle that forms the contact between the centrals should be parallel to the long axis of the face perpendicular to the incisal plane: the line angle that forms the contact between the centrals should be perpendicular to the incisal plane . over the papilla: the midline should drop straight down from the papilla.

A face bow transfer or a reference stick aligned parallel to the interpupillary plane can provide valuable information for laboratory communication about midline inclination and potential canted incisal planes (Paul 2001). In 75% of cases, the maxillary and mandibular midlines do not align; thus, using the mandibular midline as a reference

for determining the maxillary midline is not advisable. However, discrepancies between the maxillary and mandibular midlines typically do not impact aesthetics, as the mandibular teeth are not usually visible when smiling. (Paul 2001)

Figure 1-7 dental midline(Gürel 2003)

1.3.2 Incisal lengths (incisal edge positions):

The position of the maxillary incisal edge is the key factor in creating. Asmile, as it serves as a crucial reference point for determining appropriate tooth proportions and gingival levels. Various parameters are utilized to help establish the position of the maxillary incisal edge. are:

- degree of tooth display,
- phonetics
- patient input

- Tooth display during a smile can range from full visibility of the incisors to none at all. It's crucial to assess the extent of tooth visibility, especially in cases of incomplete incisor display, as this information is essential for treatment planning. This planning involves determining how much additional tooth display is necessary to achieve the ideal appearance when the patient smiles. Our findings indicate that maximum

incisor display tends to plateau around the age of 30 and gradually decreases with age for both males and female

.-Phonetics: Phonetics is a major determinant of the tooth length. In order to determine proper lip, tongue and incisal support and tooth position, it is necessary that the patient sits either erect or stands during the phonetic exercises (Al-Taki et al., 2016).

Phonetics used are as follows:

M sound: After pronunciation, the lips return to their normal rest position, allowing evaluation of the amount of the tooth display in rest position.

E sound: The maxillary incisal edge position should be positioned halfway between the upper and lower lip during the "E" sound.

F and V sounds: Fricative sounds are produced by the interaction of the maxillary incisal edge with the inner edge of the lower lips' vermilion border. Thus, fricative sounds help to determine the labiolingual position and length of the maxillary teeth.

S sound: During pronunciation, the mandibular central incisors are positioned 1 mm behind and 1 mm below the maxillary incisal edge (Bhuvaneswaran 2010)

Patient input : Intraoral cosmetic preview and provisional restorations help to confirm proper placement of the final incisal edge position(Bhuvaneswaran2010)

The proper positioning of the incisal edge is essential as it directly impacts several factors, including the angulation of the anterior teeth, labial contours, lip support, anterior guidance, lingual contours, and tooth

display. The angulation of each anterior tooth is influenced by the interaction between adequate lip support and the labial-lingual positioning of the incisal edge. This positioning affects anterior guidance as well as the labial and lingual contours. In summary, all these elements significantly contribute to both aesthetics and functionality.

1.3.3. Zenith points:

Zenith points represent the most apical position of the cervical tooth margin where the gingiva exhibits its greatest scalloping. These points are typically situated slightly distal to a vertical line drawn down the center of the tooth. However, the lateral incisor is an exception, as its zenith point can be located centrally (Al-Habahbeh, Al-Shammout et al. 2009) Figure 8. Accurately determining the location of zenith points is a key step in the process. in alteration of mesial and distal dimensions

Figure 1-8) zenith points Al-Habahbeh, Al-Shammout et al. 20

1.3. 4. Tooth inclination:

Axial inclination compares the vertical alignment of maxillary teeth, visible in the smile line, to central vertical midline. From the central to the canine, there should be natural, progressive increase in the mesial inclination of each subsequent anterior tooth. It should be least noticeable

with the centrals and more pronounced with the laterals and slightly more so with the canines. If the incisal plane is canted, the axial inclination of the anterior teeth and the midline itself, if it is at right angle to the incisal plane, will be correspondingly incorrect. (Proffit et al. 2018).

1.3.5.Tooth dimensions :

Correct dental proportion is closely linked to facial morphology and is crucial for achieving an aesthetically pleasing smile. Central dominance means that the central incisors should be the focal teeth in the smile, exhibiting attractive proportions. They play a vital role in the overall appearance of the smile. For optimal aesthetics, the proportions of the central incisors must be mathematically and visually appealing. The ideal width-to-length ratio for centrals is approximately 4:5 (ranging from 0.8 to 1.0), with a width that is 75–80% of their length being most acceptable. The shape and positioning of the central incisors significantly influence the appearance and placement of the lateral incisors and canines. (Bhuvaneswaran 2010).

1.3.6 The incisal embrasures:

The incisal embrasure should naturally and progressively increase in size or depth from the central incisors to the canines. This progression is influenced by the anatomy of these teeth, resulting in the contact point shifting downward as we move from the centrals to the canines. The apical alignment of these contact points should follow the contour of the smile line. Inadequate depth and variation in the incisal embrasure can lead to a uniform appearance of the teeth, causing the contact areas to appear excessively elongated and giving the dentition a box-like look. If the incisal embrasures are not properly formed, the unique characteristics of the incisors will be diminished.

Also, if the incisal embrasures are too deep, it will tend to make the teeth look unnaturally pointed. As a rule, a tooth distal to incisal corner is more rounded than its mesio incisal corner(Proffit et al. 2018).

Figure 1-9 incisal embrasures (Gürel 2003)

1.3.7 interdental contact area and point

A- contact area :

The connector between the central incisors should measure 50% of the height of the central incisor crown. The measurement between the central incisor and the lateral incisor should be 40% of the length of the central incisor, while the measurement between the lateral incisor and the canine should be 30% of the length of the central incisor, following the 50-40-30 rule . An inadequate connector relationship may arise from incorrect angulation of adjacent teeth or a triangular tooth shape. The latter can be addressed by performing interproximal enamel reduction followed by orthodontic space closure. Additionally, the ideal ratio of papilla height to the height of the central incisor is 40% (Gill, 2017).

***B*- Interproximal contact area (ICA):**

It refers to the broad area where two adjacent teeth make contact. This area adheres to the 50:40:30 rule concerning the maxillary central incisor. The increasing interproximal contact area (ICA) contributes to the perception of longer teeth by appearing wider and extending downward to eliminate black triangles. (Al-Taki et al., 2016).

***C*- Interproximal contact point (ICP):**

It is the most incisal aspect if the ICA. As a general rule, the ICP moves apically, the further posterior one moves from the midline .(Bhuvaneswaran 2010)

Figure 1-10 interdental contact

1.3.8. Buccal corridor :

The distance between the angle of the mouth when smiling and the buccal surface of the farthest maxillary molar is known as the buccal corridor's width. To make the smile appear wide, this should ideally be kept to a minimum. Numerous variables influence the buccal corridor: 1. Arch shape and width. The buccal corridor will shrink as arch width increases. The dental arches can only be enlarged within reasonable

bounds for stability. 2. The location of the anterior maxilla. With orthognathic surgery, the buccal corridor width decreases as a larger portion of the maxilla is shifted forward. 3. Molar tilt. Premolars and molars that are palatally inclined widen the buccal corridor. (Sarver & David, 2020)

1.3.9. Sex, age and personality:

Lombard has characterized anterior estheticism as the reflection of an individual's personality, age, and gender in the shape and form of their teeth. Clinical studies conducted by Frush and Fisher focused on the sex, personality, and age (SPA) factor, which established the norms for these investigations. (Raked, 2018)

Masculine and feminine traits significantly influence the aesthetics of an attractive smile. In Western culture, femininity is often associated with delicacy and softness, while masculinity is linked to vigor and angularity. According to Frush and Fisher, femininity in women is characterized by roundness, smoothness, and softness. Conversely, masculinity is defined by a "cuboidal, hard, muscular, vigorous appearance, which is typical of men." Signs of aging that reflect these masculine or feminine characteristics can also be observed in the contours and positions of natural teeth. Specifically, if the incisal edges of the maxillary incisors, particularly the lateral ones, appear more rounded, this contributes to a delicate and feminine smile. Such softer, rounded lines enhance the gentle Features typically associated with femininity include rounded incisal edges and transitional line angles of the teeth, often described as having a translucent appearance (Raked, 2018). Additionally, white hypoplastic striations can create an illusion of delicacy (Gürel 2003). In contrast, male dentition often showcases square, blunt incisal edges that

contribute to a more masculine look. However, it's important to note that not all characteristics of a male's teeth will strictly fit the masculine category, nor will all of a female's teeth align with feminine traits. It is quite common for individuals to display a mix of features from both sexes within the same dental arch. Various factors influence how these characteristics are perceived.s.Our cultural background, personal artistic ideals and esthetic values are all to be taken into consideration. (Raked, 2018).

1.3.10. Symmetry and balance :

Symmetry is the harmonious arrangement of several elements with respect to each other. Symmetrical length and width is most crucial for the centrals. It becomes less absolute as we move further away from the midline .

There are two types of symmetry :

- Static symmetry: mirror image, maxillary central incisors
- Dynamic symmetry: two objects very similar but not identical. Playing with perfect imperfection in the laterals and canines allows for a more vital, dynamic, unique and natural smile.
- Balance is observed as the eyes move distally from the midline, so that both the right and left sides of the smile are well balanced.(Bhuvaneswaran 2010)

1.3.11. Chroma and value:

A tooth's value, or brightness, is higher in younger patients. and lowers as they get older. On the other hand, chroma, or colour saturation, rises with age and is lower in younger patients (Sarver & David, 2020)

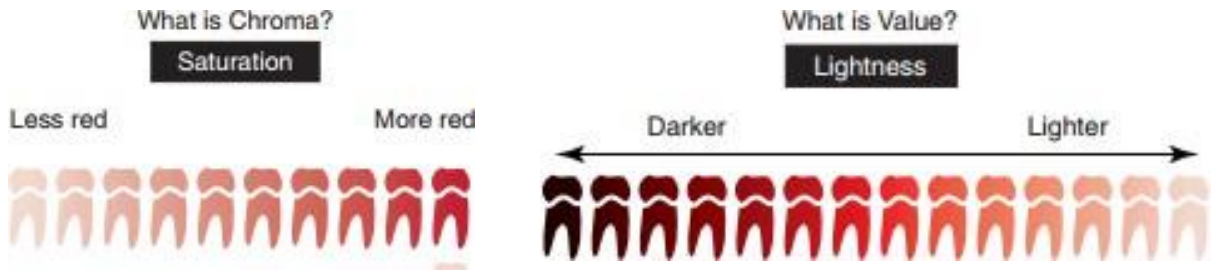

Figure1- 11chrome

1.3.12. Teeth color:

The colour of natural teeth is multicoloured. Their gingival third often has a higher chroma, while the middle third has a lower chroma and a higher value. The halo effect is frequently used to frame the transition to incisal translucency, which defines the incisal third. The maxillary lateral incisor's chroma and value are often identical to those of the central incisor. In the maxillary canine, the value is lower and the chroma is typically higher, particularly in the gingival third. The halo effect rarely happens in the maxillary canine, and incisal translucency is typically very low. If the aim of porcelain restorations is natural beauty, polychromaticity inside the tooth and between adjacent teeth is crucial. (Sarver & David, 2020)

1.3.13. Color modifiers:

It has been stated that hair color, skin color, and lipstick color all significantly affect shade selection when restorations are being placed in the esthetic zone (Pound, 1962).Of these modifiers, skin color is by far the most important (Sabherwal et al., 2009). A given tooth shade will look lighter and higher in value in a patient with darker skin. Conversely, the same tooth shade will appear yellower and lower in value in a patient with very light skin. When choosing a tooth shade for a patient with variable skin color, for instance, a white patient with a deep tan, the impact of the skin color must be discussed with the patient prior to

treatment. If porcelain restorations are placed while the skin is tanned, the restorations will appear to become more yellow and lower in value as the skin color lightens(Sabherwal et al., 2009).

1.3.14. Halo effect :

The natural incisal edge anatomy of the maxillary incisor commonly imparts a thin, white, opaque ―halo effect‖ at the incisal edge that frames the incisal translucency. The halo effect is incorporated into porcelain restorations by building the sharp incisal edge anatomy into the crown or porcelain veneer. (Proffit, W et al. 2019)

Figure1-12 halo effects

1.3.15. Surface texture:

Younger patients have more surface texture, whereas older patients have less (Heymann, 1987). The quantity of surface texture determines the surface lustre. As a result, the immature tooth with more surface roughness is less shiny. The surface lustre rises with age as the surface texture wears away. Either the articulating paper or the silver powder can be used to determine the surface texture map.

It is important to communicate with the laboratory technician about texture and luster. For example, porcelain veneers with low value, low surface texture, and high luster are not appropriate for a 25-year-old patient. (Sarver & David, 2020)

Figure 1-13surface texture

1.3.16. Width-length proportion of anterior teeth :

As a single tooth, the central incisor should have a width-to-height ratio. In a pleasant grin, the maxillary central incisors' ideal width-to-length ratio is between 75% and 80%. But according to reports, it might range from 66% to 80%. (Sarver & David, 2020)

Teeth with a width-to-height ratio of 65% will appear longer, while those with a ratio of 85% will appear square. Some people, even if they have disproportionately large teeth, have a nice grin. Consequently, the previously mentioned aspects shouldn't be regarded as a hard-and-fast rule. (Ramírez Barrantes et al., 2011)

1.3.17. tooth to tooth proportion of anterior teeth:

The golden proportion The size, form, and location of the maxillary central incisors are the most important elements in a harmonious anterior dentition. The secret to a beautiful dentition is proportion, which should match the patient's facial features, no matter how strong or weak. The maxillary central incisors must be consistent with the arch and proportionate to face morphology in order to look good. The central incisor must be in harmony with the facial shape and profile forms, and the dentist must permit natural changes in form and position. (Hasanreisoglu et al., 2005, Frush and Fisher, 1956, Frush and Fisher, 1958). The "golden proportion" refers to a mathematical theorem about the dentition's proportions in dentistry. In fact, Lombardi was the first to apply this equation to dentistry while Levin created the concepts of visual perception and how they relate to oral aesthetics (Proffit, W, 2019). This guideline states that each anterior tooth is deemed aesthetically acceptable if its width is around 60% of that of its next anterior tooth. (Proffit, W, 2019). The relationship between the anterior teeth would be flawless and consistent for all people if the original meaning of the golden proportion were to be applied to dentistry. Despite its apparent logic, this rule is extremely challenging to implement because patients actually have varying arch shapes, lip and facial proportions, and other characteristics. "Strict application of Golden Proportion is too limiting for dentistry, owing to the differences in shape of the dental arch," according to Lombardi (Lombardi, 1973). The golden proportion has yet another drawback, as said, which is that it just shows the width. It is commonly acknowledged, therefore, that width by itself is meaningless. The height-width ratio and the objects that follow are directly tied to how it is perceived. (Ward, 2015).

1.4. Soft tissues composition

1.4.1. Gingival health:

The gingiva serves as the frame for the teeth, making the overall aesthetic success of a dental case highly dependent on the health of the gingival tissues. Therefore, it is crucial to ensure that the gingiva is in optimal health before beginning any treatment. (Sarver & David, 2020)

Healthy gingiva is usually pale pink in color, stippled, firm and it should exhibit a matte surface; located facially – 3 mm above the alveolar crestal bone and located interdentally – 5 mm above the intercrestal bone papilla should be pointed and should fill the gingival embrasure right up to the contact area.

1.4.2. Gingival level and harmony:

Achieving the correct gingival levels for each individual tooth is essential for creating a harmonious smile. The cervical gingival height of the central incisors should be symmetrical and can align with that of the canines. It is permissible for the lateral incisors to have the same gingival level; however, this may result in a smile that appears overly uniform. Ideally, there should be a gentle rise and fall in the soft tissue, with the gingival contour of the laterals positioned slightly more incisal compared to the gingival levels of the centrals and canines. The gingival margin of the lateral incisors should be positioned 0.5 to 2.0 mm below that of the central incisors. The least desirable placement for the gingiva over the laterals is for it to be located apical to the central incisors or canines. (Bhuvaneswaran 2010).

1.4.3 Interdental embrasure (cervical embrasure):

The visibility of darkness in the oral cavity should not be apparent in the interproximal triangle between the gingiva and the contact area. To prevent the formation of black triangles, the most apical point of the restoration should be no more than 5 mm from the crest of the bone. Achieving this may necessitate a longer contact area that extends toward the cervical region. This approach promotes the development of a healthy, pointed papilla, rather than the blunted tissue formation that typically leads to black triangles. (Proffit, W et al. 2019)

1.4.4 Smile Line:

The smile line is defined by the lower edge of the upper lip, which determines the visibility of the teeth. This line traces along the contours of the maxillary anterior teeth, following the curvature of the inner border of the lower lip. A visually appealing smile is characterized by the angles of the mouth being aligned with both the pupillary line and the occlusal plane, with the tips of the canines just touching the lower lip. The lower lip curves upward and backward toward the corners of the mouth, meeting the upper lip. Viewers are naturally drawn to the dentition framed by the upward curve of the lips. As attention is focused on this elevation of the lower lip, it shifts toward the occlusal and incisal planes. The exposed maxillary teeth form an incisal line that is convex and aligns parallel to the upper edge of the lower lip. This line can vary among individuals and tends to be more pronounced and convex in females. (Gürel 2003).

1.5. Digital smile design

.Digital Smile Design (DSD) is a versatile dental treatment planning tool used in interdisciplinary aesthetic dentistry. It enhances diagnostic clarity, improves communication and education, and increases predictability throughout the treatment process (Coachman et al., 2014). DSD supports the restorative team by deepening their understanding of aesthetic issues and boosting patient acceptance of the final outcome (Gupta and Mittal, 2018).

This method enables the digital design of patients' smiles, providing simulations and previews of therapeutic results. Often, patients encounter dental services or procedures without comprehensive planning or discussion regarding a personalized smile design from their dentist (Cervino et al., 2019).

On one hand, DSD empowers patients to be informed participants from the outset of their treatment plan, enabling them to take on an active role in the aesthetic and functional rehabilitation of their smile. On the other hand, it helps specialists better understand the expectations and needs of their patients, facilitating the pursuit of shared goals. These protocols allow for the previsualization of clinical cases and expected outcomes, clearly demonstrating to patients the advantages of structured rehabilitation and improved collaboration with other professionals.

The process simplifies the communication of case details to dental technicians, making it easier to evaluate prosthetic, implant, and orthodontic rehabilitations through straightforward digital interactions with colleagues (Cervino et al., 2019).

this concept, largely developed by Christian Coachman, was first

introduced in 2012. Using this approach, smile design is usually accomplished with presentation software such as Keynote or PowerPoint. The DSD system only uses videos. Eight video protocols are employed: facial frontal retracted/unretracted, facial profile rest/smile, occlusal (direct), 12 o'clock, casual interview, close-up phonetics, intraoral function, and intraoral structur- al. Twelve different templates are available for designing 2D Smile Frames according to the four temperaments. The wax- up can be produced by conventional or digital methods. The DSD Connect software tool for digitization was introduced two years ago and is available in two versions (Classic and Pro). The 2D Smile Frame is positioned over the 3D model using the see-through principle. Two independent software solutions for designing DSD Smile Frames in 2D (NemoDS- D2D) and 3D (NemoDSD3D) were recently introduced.(Zimmermanna and Mehlb 2015)

the standalone software program available in two versions (Easy and Pro). A special feature is that frontal full-face photographs can be taken with the patient wearing special eyewear with reference points for the correct reproduction of proportions. Frontal full-face photographs must be taken with the patient smiling naturally.

1.5.1. Cerec Smile Design (Sirona):

Cerec Smile Design is a software tool that has been integrated into the Cerec Chairside Software (since version 4.2), and inLab Software (since version 4.2). This software only requires a frontal full-face smile photograph.

Digital Smile System (DSS)

with the lips retracted. The DSS software is only capable of smile design and does not offer the option of creating a see-through template.

1.5 .2. G Design (Hack Dental):

Two versions of this standalone software tool have been available since April 2015 (Lite and Pro), which is made by the same developers who created the DSD Connect software. The G Design software (Hack Dental, Razvad, Romania) allows the user to create a classic 2D Smile Frame, as well as a see-through template that can be used as a reference guide for different CAD systems. This system requires a retracted frontal full-face smile photograph. (Cervino et al., 2019).

1.5.3. Romexis Smile Design (Planmeca):

Planmeca (Helsinki, Finland) has been represented on the smile design software market since May 2015. Its Romexis Smile Design software is available as a standalone solution or as an integrated solution in the Romexis module. The current version of the software is Romexis Smile Design 4.2. It requires frontal full-face photographs with the patient smiling naturally and with the lips retracted. (Gupta and Mittal, 2018).

1.5.4. Smile Composer (3Shape):

Smile Composer, one of the first smile design software solutions available, was launched on the market 2 years ago by 3Shape (Copenhagen, Denmark). The current version of the module features improvements and better compatibility with conventional CAD design tools. Group processing and mirroring of individual restorations are now possible. Smile Composer is a component of Dental System 2015 CAD design software. This system requires a frontal full-face smile photograph, which is first imported into the system and aligned. (Gupta and Mittal, 2018).

1.5.5. Smile Designer Pro (Tasty Tech):

Smile Designer Pro (Tasty Tech, Toronto, Canada) is a standalone software tool, currently available in version 1.45. This system requires a frontal full-face smile photograph and additional views, such as the 12 o'clock view, to create 2D Smile Frames. Features include five prefabricated templates for tooth shapes. The software design and interface is reminiscent of that of the traditional Photoshop program. . (Gupta and Mittal, 2018).

1.5.6 Advantages of Digital Smile Design (DSD):

• DSD assists patients in visualising the predicted outcomes prior to beginning treatment. This enhances the treatment's predictability.

• Operator can motivate and educate the patient by showing the final outcome digitally before doing any irreversible procedure this can also serve in crucial medicolegal purposes.

• Clinicians and patients can both digitally visualise and analyse gingival, dental and facial characteristics that will decide the final smile and facial aesthetics.

• DSD contributes to the personalisation of smile design by exceeding patient's involvement in their own smile designing, results in a more cosmetically motivated, emotive and confident smile.

• Before the treatment begins, comparison between before and after treatment images using a digital scale, horizontal and vertical reference lines can be done. • DSD not only helps in better communication between patients and clinician but also helps in better communication between other team members, lab technician, etc., (CHITLANGE et al, 2023).

Chapter Tow

Conclusion and Suggestions

Conclusion

The principles of smile design are fundamental for creating aesthetically pleasing and harmonious results that enhance a patient’s facial features. By considering factors such as dental proportion, alignment, lip morphology, and the overall balance of facial aesthetics, dental professionals can achieve results that not only improve oral health but also boost a patient's confidence and quality of life. Integrating these principles into practice ensures that each smile is uniquely tailored to the individual, reflecting their personality and preferences while adhering to established aesthetic guidelines. Ultimately, a well-designed smile can have a transformative effect, making it a critical focus in contemporary dental treatment.

Suggestions

1. The Role of Aesthetic consideration in Modern simle Design:Enhansing Facial Harmony and patient confidence
2. . In tergrtim of cosmetic and Medical Approaches in Smile Design:Achieving Natural and Balanced Aesthetic outcomes
3. Conduct a thorough assessment of the patient's facial structure, including jawline, chin position, and cheekbone prominence. This comprehensive evaluation helps in understanding how the smile interplays with overall facial aesthetics.
4. Utilize advanced technology such as Digital Smile Design to create visual simulations of potential outcomes. This allows patients to see proposed designs and provides a more interactive decision-making process.
5. Follow the principles of dental proportionality (e.g., the Golden Proportion) to guide tooth size, shape, and spacing. This creates a balanced and harmonious appearance that complements the patient’s facial features.
6. Recognize that each patient's smile is unique. Take into account their age, personality, and lifestyle when designing treatment plans, allowing for customization of tooth color, shape, and alignment.

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