

Anterior Teeth and Smile Designing: A Prospective View

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ABSTRACT

Smile is a person's greatest beauty asset. A defective smile might be considered as a physical handicap as the mouth act as a focal point where a large share of attention is directed toward mouth and teeth, it would be nice to have some sort of tools to assess beauty, which currently does not exist.

Standards for beauty are actually a compilation and comparison of everything we have seen or experienced. Smile design is different from tooth design, with tooth design one is concerned with contour, position and color of individual teeth, while integration of these teeth into the face and facial features is paramount in smile design.

This article describes some average desirable characteristic features of smile to help and achieve optimum result in esthetic oral rehabilitation.

Keywords: Dynasthetics, Smile design, Esthetics.

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INTRODUCTION

An attractive smile enhances the appearance and acceptance of an individual in our society. Smile is one of the facial expressions that are essential in expressing friendliness, agreement and appreciation. This demand for a pleasant smile drives us to the field of dental esthetics and thus the role of a prosthodontist becomes significant.

Smile

Smile is a person's ability to express a range of emotion with the structure and movement of the teeth and lips. Smile has been classified as high, average and low by Tjan et al.¹ High smile shows complete display of cervicoincisal length of the maxillary incisors along with a contiguous band of gingiva whereas low smile has less than 75% of display. In an average smile there is 75 to 100% display of maxillary incisors with the incisal curvature of the maxillary anterior teeth paralleling the inner curvature of lower lip and may be slightly or totally touching the lower lip (Fig.1).

Design a Smile

When designing a smile, the smile artist needs to consider, the age of the patient, his or her aspiration, individual face shape, facial features and oral condition of the patient. Factors affecting smile design include:

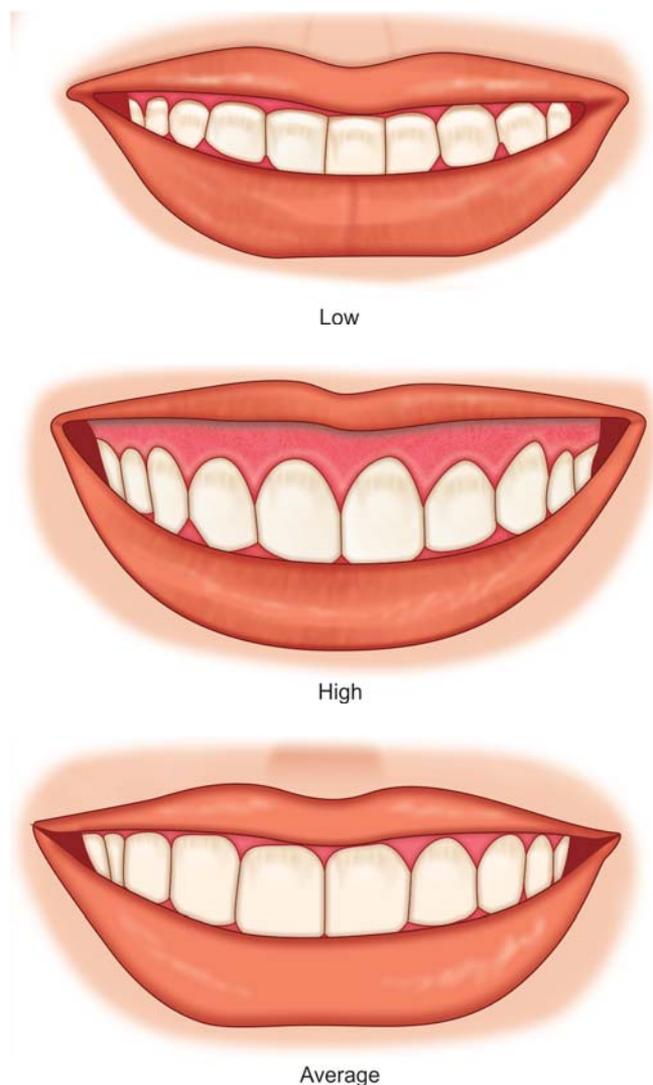


Fig. 1: Three types of smile

Age

Oral structures such as teeth, periodontium and lips undergo constant changes due to aging. These changes have to be incorporated in the oral rehabilitation of an elderly person. According to Dong et al, Ahmad et al,^{2,3} the amount of maxillary incisor exposure gradually decreased with age with a corresponding increase in the mandibular incisor exposure. This feature has to be inbuilt in the artificial denture to provide a natural esthetic appearance to the patient.

Oral Conditions

Missing teeth disrupt a good smile. Dong et al² investigated the effects of missing teeth, prostheses and misaligned teeth.

Results revealed that missing or malaligned teeth impair smile. But if the missing teeth were restored, then the esthetic level of smile improved.

Sex

Generally, feminine teeth are round and masculine teeth are squared, but there are no hard and fast rules. According to gender differences, females display nearly twice the amount of maxillary teeth, i.e. 3.4 mm as compared to males which is only 1.9 mm.^{3,4}

Personality

Dong et al² investigated the correlation between personality factors and smile assuming that smile esthetics is closely related to an individual's physical and psychological state. There was no statistically significant relationship between men's personality and smile. In contrary, women exhibited some correlation. This indicates that artificial teeth of female patients have to match their personality trait.

All these factors affecting smile should be considered when a denture is made as they affect the esthetic outcome.

Evaluation of a Smile

A person is more often viewed from the frontal aspect than the profile. Therefore, smile has to be esthetically appealing when viewed from the front. Lombardi⁵ pointed out that, esthetic qualities can be determined by viewing the patients from front, in conversation, with facial expressions and smiling. Smile needs to be considered in both vertical as well as transverse direction. Characteristics observed in vertical and horizontal directions are as follows:

Vertical characteristics observed include the relationship between the incisal edges of the maxillary incisors and the lower lip.

Transverse characteristics include arch form, buccal corridor and transverse cant of the maxillary buccal plane. These factors have to be incorporated in the artificial teeth replacement because as the patient smiles, the teeth are exposed.

The inter-relationship between the artificial teeth and smile can be bridged by applying principles of visual perception and dynasthetics considerations.

PRINCIPLES OF VISUAL PERCEPTION AND SMILE DESIGN

There are various factors that govern the principles of visual perception. Following are some of them which has to be considered in the process of denture construction.

Composition

The study of the relationship existing between objects made visible by contrasts in line, color and texture is called composition.

Symmetry is the prime requisite for composition⁵ which means oneness. It is this property that gives the effect of as 'a whole'. The objective of a prosthodontist is to provide a dynamic unity and not a static one. The typical denture look is obtained when we give a static unity, which is the biggest crime in denture esthetics. Asymmetry may be given among the dental composition by binding all the elements together with segregating forces, i.e. all the teeth within the denture need not be arranged uniformly which gives the picket fence appearance to the denture. Instead the teeth can be arranged with variations within the framework of the dental composition, e.g. Hogarth's line of beauty (Fig. 2). It is a line inscribed around a cone. The line is never the same along its course but neither has it left away from the surface. Adoption of this segment of line can be used for tooth placement. This along with the festooning of the base contributes to dynamic unity.

Dominance is the factor required to provide symmetry, i.e. one tooth must dominate in the anterior tooth arrangement, by virtue of its size central incisors being the right choice. The central incisor must be larger than the lateral incisor to dominate the composition.⁵ The canine is not used because only its mesial aspect is seen.

Alternative methods to increase dominance includes:

- Increasing mold size
- Using lighter teeth
- Placing teeth farther anteriorly
- Increasing exposed cervicoincisal length.

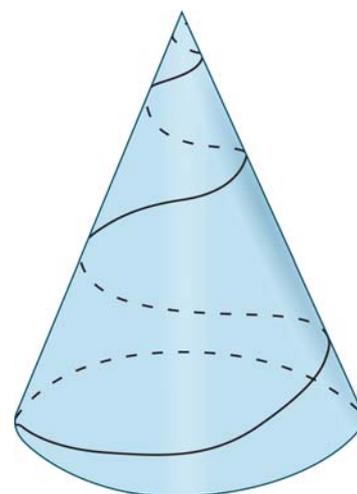


Fig. 2: Hogarth's line of beauty

But, however, the amount of dominance given to the mouth by the denture set up depends upon the evaluation of the patient's personality and the strength of the background facial features.

Proportion is a valuable tool to provide symmetry with variety, i.e. if two teeth are of the same width but different lengths, the longer tooth will appear to be narrower (Fig. 3). This can be made use to achieve dynamic unity. Correct dental proportion is the key to a beautiful smile. These proportions are usually based on perceived sizes viewed from the frontal aspect. Though various proportions were proposed like the golden proportion, recurring esthetic dental (RED) proportion, M proportions and Chu's esthetic gauges,⁶ most authors recommend creating harmony and balance, by eye through proper adjustment and evaluation of provisional rather than by using any rigid formula.

Symmetry, dominance and proportion are thus essentials of a proper dental composition.

Gradation

Gradation⁵ is the progressive decrease in tooth size as we move from the anterior teeth to posterior teeth and this front to back transformation must be gradual. If two structures that are similar are placed at different distances, then the structures which are nearer will appear larger. If other similar structures are interposed between them, then this creates an illusion of gradual reduction in size. If this principle is marred, it destroys the depth of realism.

For example, use of a short premolar violates the principle of illusion since abrupt size reduction disturbs the gradual diminution in size (Fig. 4).

Buccally placed premolar is also a sin against esthetics since it destroys the illusion depth and makes the denture look unreal (Fig. 5).

The inclusion of buccal corridor also helps in achieving gradation by altering the light needed for illumination, i.e. as the teeth are set posteriorly, the available light required for illumination gets reduced and hence the tooth appears to be smaller.

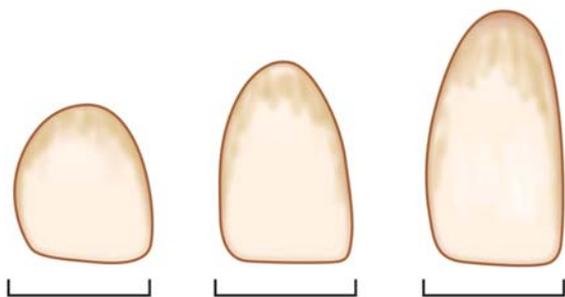


Fig. 3: Proportion



Fig. 4: Principle of illumination—short bicuspid

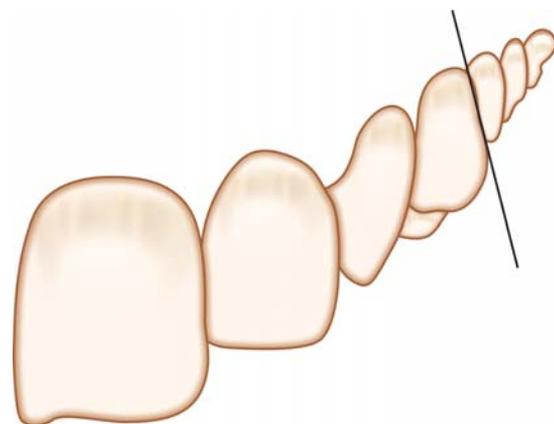


Fig. 5: Principle of illumination—buccally placed bicuspid

Balance

Balance is one important factor to be considered in denture esthetics. It denotes the stability resulting from equalization of opposing forces. It means that no part of a component is out of proportion to another. In other words, it is also called as equilibrium.

If a structural map of lip is drawn, then the most stable point is at the intersection of the structural axes. When a question arises about the placement of the midline, either in the middle of the head or the middle of the mouth, the answer according to balance should be at the point where it remains stable, which is mostly the imaginary midline that divides the philtrum of the upper lip. However, the midline cannot be measured, but a long contemplative look will reveal the position of the midline as eye is a competent evaluator (Fig. 6).

Balance is not only essential in establishing midline, but is also required in establishing the direction of teeth on either side of the midline. The lack of balance in direction is mostly due to cross bite ridge relation in which the canine is not placed lingually in relation to the lower canine (Fig. 7).

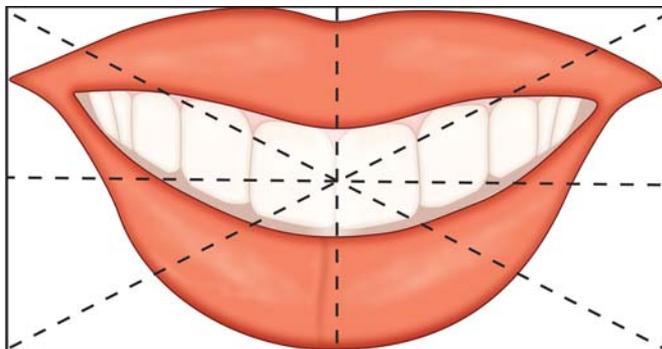


Fig. 6: Proposed structural map of tooth

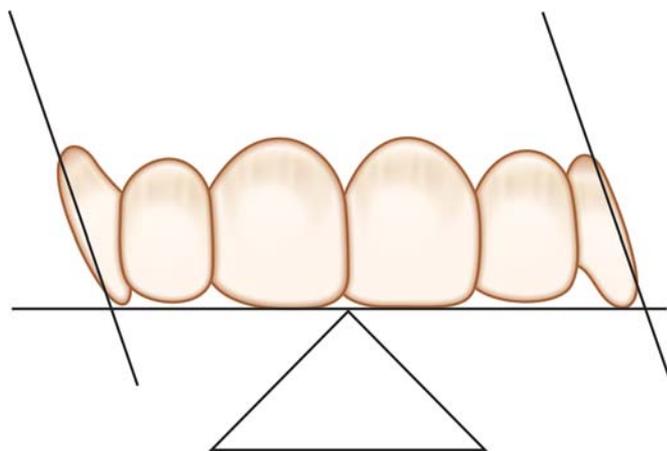


Fig. 7: Balanced of direction

Thus, the direction of teeth must be balanced; otherwise the resulting arrangement of artificial teeth will look transitory and unplanned.

Balance should also be obtained in terms of visual weights in the dental composition over a centrally located fulcrum. Visual weights are nothing but elements on either side of the midline requiring equal weightage. Visual weights that have to be managed in a dental composition are the teeth, spaces between the teeth and added gold restorations.

For example, If a gold restoration is present on one side of the midline, then this visual weight has to be compensated on the other side either by a diastema between the lateral and the canine or by a larger canine or a labially prominent canine.

Any visual weight added on one side of the fulcrum thus, requires a balancing compensation on the other side of the midline.

In denture esthetics the balancing problem is complicated by the fact that the patient sees the prostheses in the mirror in which the left and right are reversed. It is always advisable for the dentist to make the wax try in with the mirror along with patient to avoid confusion. An esthetic denture has its midline placed in a stable position with the visual weights and directions on either side in a state of equilibrium.

DYNASTHETICS AND SMILE DESIGN

The term dynasthetics implies movement, action, change and progression in the esthetic phase of prosthodontics.⁷ Dentogenic factor (SPA factor) is the application and correlation of dynasthetic principles. Dynasthetics are only a guide and they are not a compulsion wherein freedom is given to our imaginative perception.

Age

Age changes influence the anatomy of smile. With age, not only the lips become less elastic and less everted, teeth also show imperfections. These can be incorporated to the artificial denture teeth in the form of crazed or fractured tooth, attrition, gingival recession, abrasion and erosion.

For example, Abrasive wear: As age advances, there may be progressive abrasion of the natural tooth. A cut can be made on the incisal edge to simulate abrasive changes (Fig. 8).

Erosion: A posterior diastoric tooth can be modified to simulate erosion (Fig. 9).

Personality Changes related to Sex

A delicate mold is feminine and a vigorous mold is masculine. A medium pleasing personality mold can be made more masculine or feminine by squaring or rounding the incisal edges (Figs 10 and 11). These personality changes

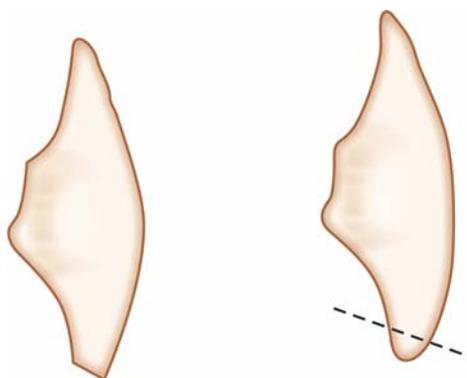


Fig. 8: Simulation of abrasive wear of natural tooth

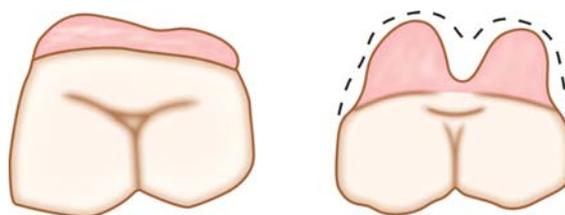


Fig. 9: Simulation of erosion in posterior diastoric tooth

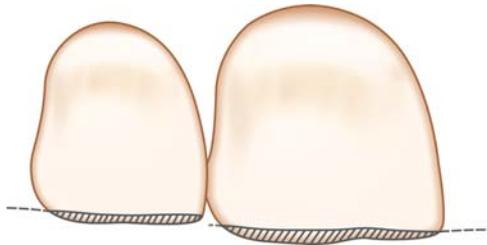


Fig. 10: A medium personality mold appear more masculine

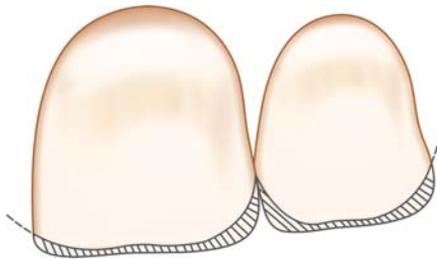


Fig. 11: A medium personality mold appear more feminine

with respect to sex can be incorporated to provide gender differences in complete denture fabrication.

In selecting the artificial anterior teeth, it is useful to follow the 1, 2 and 3 guides⁵ which are as follows:

1. *The central incisor expresses age:* Youthful teeth has unworn incisal edge, defined incisal embrasure, low chroma and high value.
Aged teeth have less smile display, shorter teeth, high chroma and low value.
Thus, age differences can be given by altering the shape, size, chroma and value of the central incisors.
2. *The lateral incisor expresses sex characteristics:* Feminine and masculine differences can be incorporated in the shape of the lateral incisors.
Feminine: Shape of the lateral incisor can be made more round and smooth.
Masculine: Shape altered to be cuboidal and squarish.
3. *Canine teeth express personality:* Different personality traits can be established with the cusp form of the canine teeth.
Aggressive, hostile angry personality requires a pointed long cuspal form.
Passive, soft personality, blunt, rounded and short cuspal form can be given.
These SPA factors play a significant role in applying the principle of dynasthetics.

Speaking Line

Speaking line is the incisal length measured when the patient speaks. This speaking line is important since it acts as a

reference to establish the cervicoincisal length and the amount of exposure of the anterior teeth.

A guide to the vertical composition using incisal edges of the central incisors in their relationship to the lipline at rest as a measure is as follows:⁷

- Young man: 3 mm below lipline at rest
- Young woman: 2 mm below lipline at rest
- Middle age: 1.5 mm below lipline at rest
- Old age: 0-2 mm below lipline at rest.

These values give an idea about the amount of visibility of the central incisors which can be modified in accordance to the patient's esthetics.

Smile Line

Smile line is an imaginary line along the incisal edges of the maxillary anterior teeth that should mimic the curvature of the superior border of the lower lip during smiling. Reverse smile line occurs when the centrals appear shorter than the canines along the incisal plane (Fig. 12). This creates an unesthetic appearance when the patient smiles, hence reverse smile line are not accepted in a complete denture construction.

Depth Perception

Depth perception⁷ is limited in the artificial tooth since the contact area is nearer to the labial surface in contrast to the natural teeth. Thus, the contact area can be increased by depth grinding, i.e. a cut can be made on the labial mesial line angle of the artificial tooth. It gives an illusion of the appearance of the natural teeth in an artificial denture (Fig. 13).

Buccal Corridor

Buccal corridor is the space created between the buccal surface of the posterior teeth and the corner of the lips when the patient smiles. The inclusion of buccal corridor in dentogenics is important in achieving the gradation effect. This effect is achieved by progressively altering tooth illumination. Existence of buccal corridor in an artificial denture is critical as it provides an added illusion of reality.⁵

The appearance of buccal corridor is influenced by:

- Width of maxillary arch
- Tone of facial muscles
- Positioning of the labial surface of the upper premolars
- Prominence of the canines particularly at the distal facial line angle.

Arch form also has a direct influence on the buccal corridor.⁶ Ideal arch is a broader one that conforms to U shape which can provide the space required for the buccal

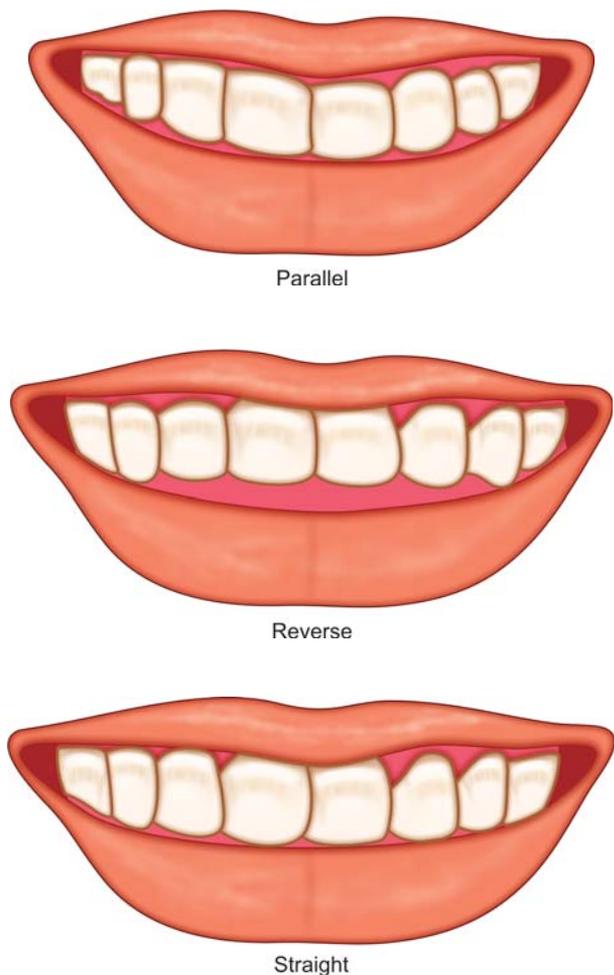


Fig. 12: Types of maxillary incisal curvature in relation to lower lip

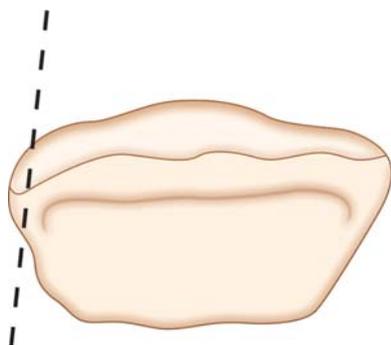


Fig. 13: Depth perception

corridor. The buccal corridor should not be completely eliminated because it imparts the quality of depthness to the artificial smile (Figs 14 and 15).

Negative Space

Negative space provides the illusion of teeth by portraying the dark space of the mouth behind the teeth (Fig. 16). This is important as it gives the composition of the object depicted, i.e. the teeth. A correct interincisal distance

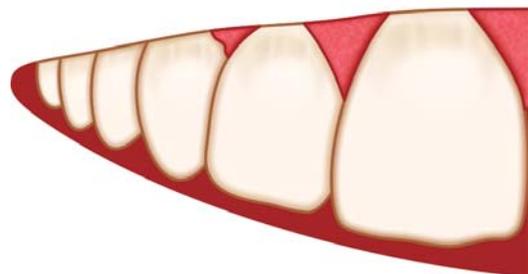


Fig. 14: Insufficiently developed buccal corridor

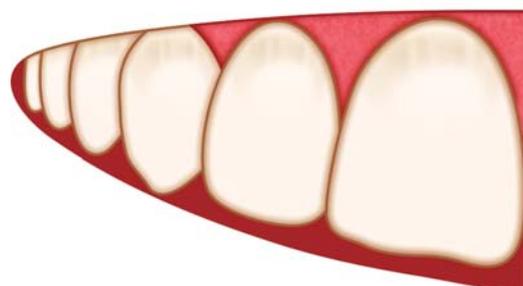


Fig. 15: Properly developed buccal corridor

between the maxillary central incisors, laterals and canine is necessary to create an attractive incisal curvature and the esthetically required dynamic negative space,¹ shape of which is affected by the lower anterior teeth.

With much discussion about smile designing, it will be an offence if dental composition is not discussed, as it is the teeth that are exposed during smiling. Our ultimate goal as a prosthodontist is to achieve a pleasing composition in smile by creating a harmony of various dental elements.

DENTAL COMPONENTS AND SMILE DESIGN

Incorporation of basic features of proximity—a well-aligned teeth without diastema, similarity in shape and shade of teeth, continuity denoted by repeated ratios in widths of anterior maxillary teeth results in stability and harmony of the dental components in smile design.



Fig. 16: Negative space

Tooth Size

Though various proportions have been proposed to establish an esthetically pleasing smile, these are used only as a guide rather than a rigid mathematical formula.⁸ Factors guiding individual tooth dimensions are as follows:⁶

Maxillary Central Incisor

They are the focal point of a pleasing smile and should be dominant than the rest of the teeth. Approximate length of the central incisors should be 10 to 11 mm and the width is calculated accordingly so that the ratio falls between 75 and 80%.

Maxillary Lateral Incisor

They are never symmetrical and influence gender characterization.^{7,9} They are 2 to 3 mm lesser in width when compared to central incisors.

Maxillary Canine

It depicts the personality.^{7,10} Canine is wider than the lateral incisor by 1 to 1.5 mm. Also canine and central incisors are longer than lateral incisor by 1 to 1.5 mm.

Midline

Midline refers to the vertical contact interface between the two maxillary central incisors. Midline should be:

- Parallel to the long axis of the face
- Perpendicular to the incisal plane
- Over the papilla, i.e. the midline should drop straight down from the papilla.

A well-placed midline in conjunction with a solid interproximal contact relationship between two central incisors produces a desirable effect of cohesiveness of the dental composition. A midline diastema divides dental composition into two separate entities and disturbs the cohesiveness of the dentition. Various anatomical landmarks are used to establish the midline. They are midline of the nose, forehead, chin, philtrum and interpupillary plane. Among these anatomical guide posts, the philtrum of the lip is the most accurate (Fig. 17).⁶

It is also to be noted that maxillary and mandibular midlines do not coincide in 75% of cases.⁶ So it is inappropriate to use mandibular midline as a reference point for establishing the maxillary midline.

Tooth Inclinations

Axial inclination is used to compare the vertical alignment of the maxillary teeth to the central midline. It also refers to

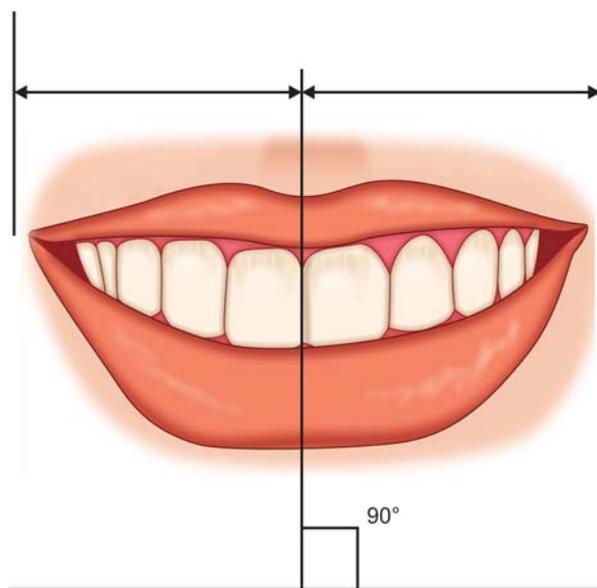


Fig. 17: Determination of midline by dividing middle lobe of upper lip

the degree of tipping in any plane of reference. The guideline for labiolingual inclination is as follows (Fig. 18):

Maxillary Central Incisor

Maxillary central incisor can be positioned vertically or with slight labial inclination depending upon the lip support required.

Maxillary Lateral Incisor

Cervical part of the maxillary lateral incisor is more lingual than the incisal edge.

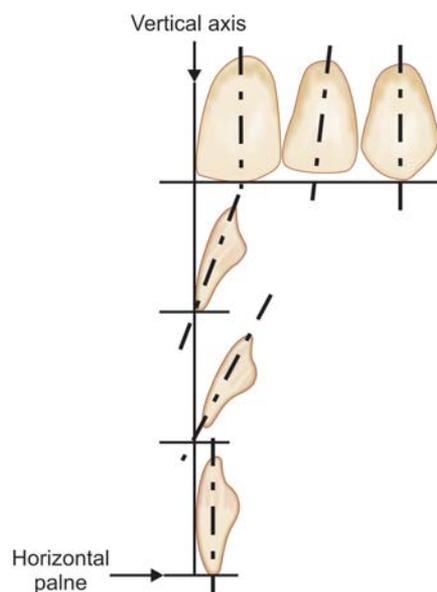


Fig. 18: Relationship of upper front teeth to horizontal plane and vertical axis

Maxillary Canine

Neck of the canine is positioned more labially than the cuspal tip.

Interdental Contact Area

It is defined as the broad zone in which two adjacent teeth touch. It follows the 50:40:30 rules⁶ in reference to the maxillary central incisor, i.e. as we move from canine to the central incisors, there is a gradual increase in the interdental contact area (Fig. 19).

Incisal Embrasure

The incisal embrasure is the divergence of the proximal surface of the anterior teeth from the contact point incisally. Incisal embrasure gradually increases in size from the central incisors to the canine. As a result the contact points also move apically. Failure to provide depth and variation to the incisal embrasures will result in uniform, box-like appearance of the anterior teeth. If the incisal embrasures are too deep, then it makes the teeth look unnaturally pointed (Fig. 20). This presence of an incisal embrasure gives freedom to the dental composition.

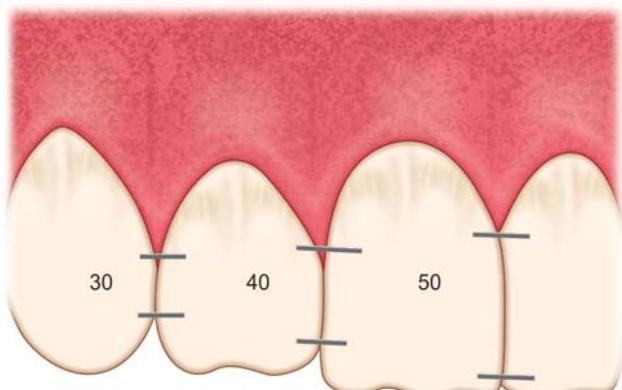


Fig. 19: Interdental contact area

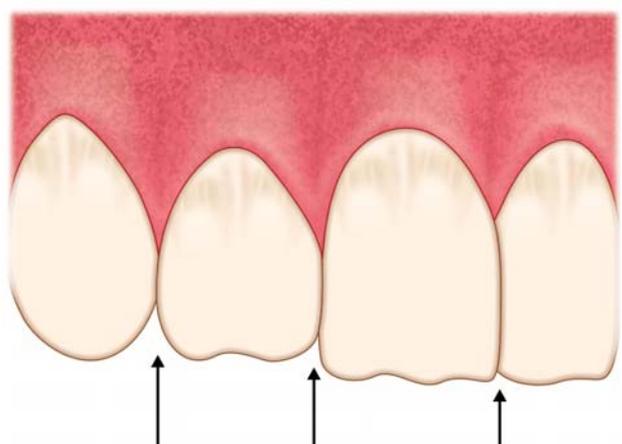


Fig. 20: Incisal embrasure

Interproximal Contact Point

It is the most incisal aspect of the interproximal contact area. Interproximal contact point moves apically as we move posteriorly from the midline.

Interincisal Distance

A correct interincisal distance among the centrals, laterals and canine is necessary to create an attractive incisal curvature that parallels the inner curvature of the lower lip which is called incisal silhouette¹¹ and also creating a dynamic negative space. Smile line is related to the interincisal distance. A sharp curve denotes youthful smile line, whereas a broad curve indicates an older dental composition (Fig. 21).

Smile line can be defined as silhouette that incisal edges of upper teeth meet against negative space, i.e. the darkness of the open mouth. This can be easily manipulated by lengthening or shortening of central incisors, minimizing or maximizing the incisal embrasure and by deepening or flattening of arch form.

Incisal Edge Position

Incisal edge position is determined by the degree of tooth display required, phonetics and the patient information. This position is crucial since it gives the pitch of the anterior tooth which is determined by lip support and the labiolingual positioning of incisal edge.

Tooth Alignment

Incorporating mild rotation of teeth as found in natural teeth can be attempted. Maxillary lateral incisor, generally have

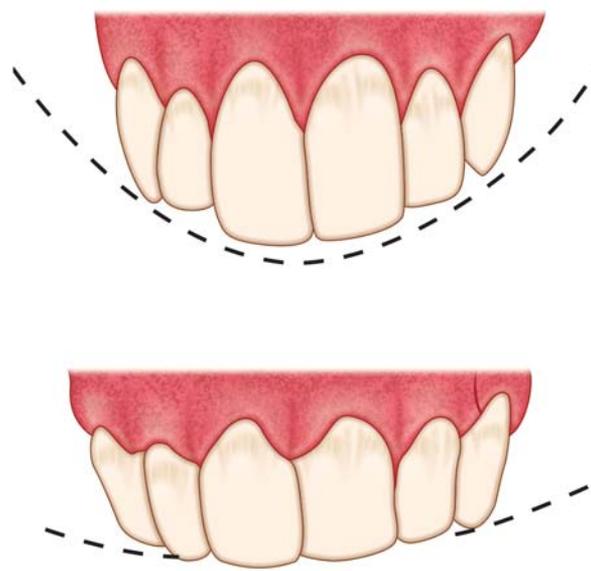


Fig. 21: Different smile lines

the most predominant irregularities.¹² Irregularities can be introduced in accordance with the patients' desires, but nevertheless should violate the rules of nature.

PREPLANNED ESTHETICS

After considering the dental components in smile designing, planning esthetics will be our next phase. Preplanned esthetics determines the tooth space allocation of the proposed denture. Features to be considered include width and height of the teeth and the location of the commissures of the mouth.

The edentulous space is visualized as the surface to be utilized for a dental composition, followed by establishing the midline after which space for each tooth is horizontally allocated (Figs 22 and 23).

The space for each tooth follows a ratio:

$A/B = B/C = C/D = D/E = E/F = K$, where K is a constant.

Once incisal length is established, the actual tooth shapes are then placed in the area that is assigned (Figs 24 and 25). The paramount issue of gaining esthetic approval in a composition is ensuring harmony and balance, irrespective of size or ratio.

COLOR IN DENTURE ESTHETICS

Color is also an important factor when considering anterior teeth, which forms the most visible area of a smile. Hue is

of not critical importance since the concentration of hue in dental shades is very less. The factors that play a major role in shade selection are:

Value

Selection of appropriate value results in successful shade selection. Lightness or darkness of a particular hue is called as value. The lightness or darkness of the tooth is affected by the amount of light striking the tooth that will be reflected to the beholder's eye, i.e. the teeth with better illumination appear lighter. Hence, anterior teeth appear lighter than the posterior teeth.

Tooth Texture

Value is affected by the texture of the tooth. Glazed surface or less convoluted reflective surface reflects more light than unglazed surfaces. Thus, a tooth receiving more light appears lighter than when it is receiving less light. Hence, the surface finish of the artificial tooth also plays a vital role.

Light Source

Light source is yet another factor that requires special mention. It is not advisable to select shades under particular

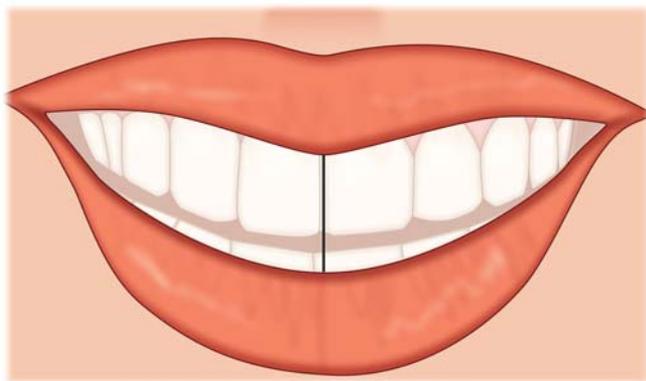


Fig. 22: Preplanned esthetics—midline established

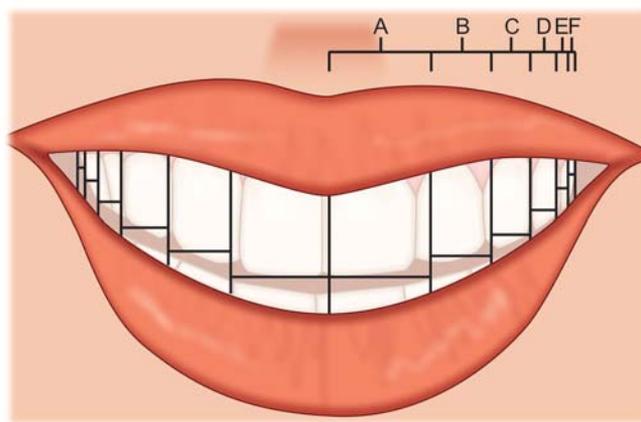


Fig. 24: Vertical space allocation

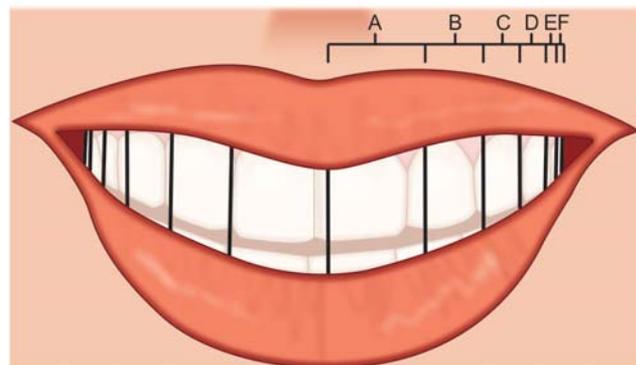


Fig. 23: Horizontal space allocation

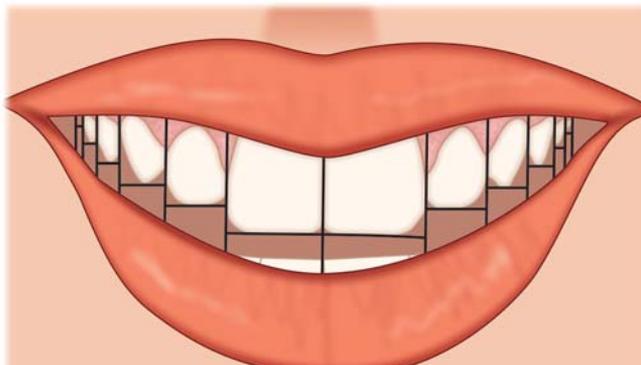


Fig. 25: Actual tooth shapes assigned

light sources as the patient is subjected to different environmental (lighting) conditions as he or she goes about her daily routine. So shade has to be selected such that it merges with the total facial composition.

Background

In female patients, try-in must be done when the patient wears her lipstick because the lipstick gives the background, mouth outline form and it also forms a unifying border.

Personality

Personality may be classified as strong, average and soft. A strong personality is the one who is dynamic with full of energy whereas a weak personality is exactly the opposite of former. Thus, a strong personality indicates a need for stronger tooth arrangement and therefore lighter shade selection.

Facial Features

Dental composition has to complete with the facial features to ensure better esthetics. If there are strong facial features such as a large nose or dark hair, then lighter teeth are used to harmonize the mouth with the total facial structure.

Thus in complete denture construction, it is insignificant to select a particular shade for the artificial teeth, but it is mandatory that teeth of different shades should be used within the composition. There should be also mixing of shades within each tooth as contributed to the original teeth by nature¹² to provide a sense of realism.

After a pronounced discussion about anterior teeth and smile designing, it can be appreciated that smile and anterior teeth are both inter-related to each other. With either one's separate existence being irrelevant, together they strive in achieving denture esthetics.

DISCUSSION

Esthetics has become increasingly important in the practice of modern dentistry. The goal of this makeover is to develop a peaceful stable, masticatory system, where the teeth, tissue, muscles, skeletal structures all function in harmony. The demand for esthetics motivates the patient to seek dental treatment which is often dictated by cultural, ethnic and individual preferences.

The parameters of an esthetic smile are smile type, parallelism of teeth, position of the incisal curve, number of teeth displayed along with perceptual principles like composition, balance, gradation. These can free dentists from the confusion existing in the field of dental esthetics.

This may be applied to all but they eliminate the personal attributes of talent and the need for learning specific formulas that can be eluded as sins in the field of esthetic dentistry, the sin against the principles of visual perception and the sin against principles of reality.

Unfortunately, the factors which govern the restoration of natural appearance for edentulous patients are often discussed, but frequently misunderstood. This dental art does not always occur automatically or are present in the nature, but is purposely and carefully incorporated into the treatment plan, thus creating an attractive smile, which enhances the acceptance of an individual in our society.

CONCLUSION

Smile pattern of the individual patient will depend on arrangement of anterior teeth in accordance with the principles of dynasthetics and visual perception. It is regrettable to find that the appearance of an edentulous patient is decided by the dental technician setting the artificial teeth who has never seen the patient by himself. It is the sole responsibility of the prosthodontist to accomplish a complete denture treatment that is much more than mechanics. The importance of dental art as proposed in the statement: 'My physician keeps me alive but my dentist makes my life worth living' should never be underestimated.

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