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Principles for Establishment of Esthetics in Fixed Prosthodontics: A Review

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ABSTRACT
Teeth are important not only from functional point, so it is important to have an organised and systematic approach in order to evaluate, diagnose and resolve the esthetical problems. As clinicians we should aim at achieving pleasing composition for the smile by considering all aesthetic components. The aim of this article is to review principles for establishment of aesthetic art of smile in fixed prosthodontics.

INTRODUCTION

- Teeth are important not only from functional point, but also because they contribute substantially towards psychological well-being of the person and further, the tooth loss in the aesthetic zone in younger patients is a catastrophic event, which is mainly attributed to the genetic, caries, and traumatic injuries.
- Tooth loss due to any of the above reasons not only impairs function but also affects the social welfare of the patients. Replacement of this by a faulty prosthesis, leads to compromised esthetics, inflammation and hyperplasia in the tissues and mechanical failures of the prosthesis.
- Absence of anterior teeth not only handicaps the esthetics but also affects the phonetics, incising of food and most importantly affect the anterior guidance which is a necessity for the protection of posterior teeth.[1]

Aesthetic dentistry: Art and science of dentistry applied to create or enhance the beauty of an individual within functional and physiological limits.

Appearance Zone

- This is the anterior oral area where aesthetics is of prime concern & which is visible on smiling, from maxillary premolar to premolar (usually 1st molars also).
- Depends on the person's self-image, mouth size, teeth size, smile width, lip size and tightness.[2]

GENERAL PRINCIPLES OF AESTHETICS

Composition/Contrast:
The relationship between the different parts of the face (facial), the teeth and the gums (dental) made visible by contrast constitutes the dento-facial composition (Fig 1)[2]

Fig 1

International Journal Dental and Medical Sciences Research
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GENERAL PRINCIPLES OF AESTHETICS

Unity: Unity between different parts of the face and teeth is essential to give the effect of oneness or wholeness to the dento-facial composition

i. Static unity
ii. Dynamic unity
iii. **Static unity:** Geometric or regular shapes such as inorganic shapes and forms.
iv. **Dynamic unity**: Active, living, growing which is seen in plants and animals.

Cohesive and Segregative forces:

1. Cohesive forces: Any element which tends to unify a composition is a cohesive force. E.g.:two parallel objects.
2. Segregative forces: Elements which break the monotony of the composition
3. Naturalness has combination of cohesive and segregative forces. A proper mix of segregative and cohesive forces adds variety to the composition making it more dynamic and interesting(fig 2)

Fig 2

Dominance: it exists when a strong centralized structure is surrounded by well-demarcated, characterized structures. In a dento-facial composition it creates immaculate unity leading to a harmonious composition. The absence of dominance makes the composition weak. Color, shape and size are the factors which can control dominance.[3](Fig 3)

Fig 3

Symmetry: Regularity in the arrangement of forms or objects.

i. Horizontal symmetry: all elements are align
ii. Radiating symmetry: one part of the composition is mirror image as the other side.(fig 4)

Fig 4

Color, form and lines:

These provide dominanceto a composition.Color predominates over forms, lines and angles. According to A. H. Munsell,(fig 5)

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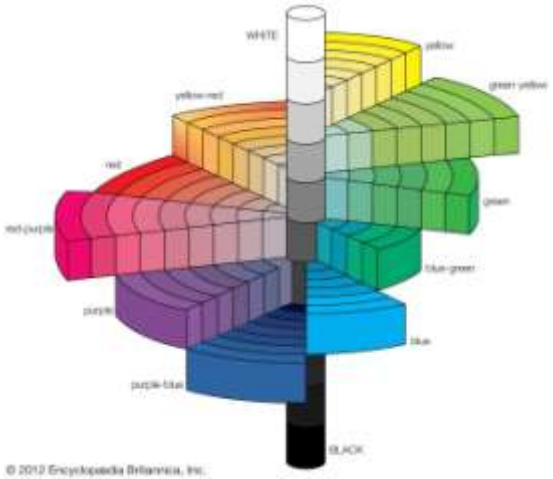

MUNSELL'S COLOR WHEEL

Fig 5

- Many factors that are part of biologic or structural beauty depend on the visualization of **LINES.**
- The direction of lines can also create optical illusions.

Parallel
Perpendicular(fig 6)

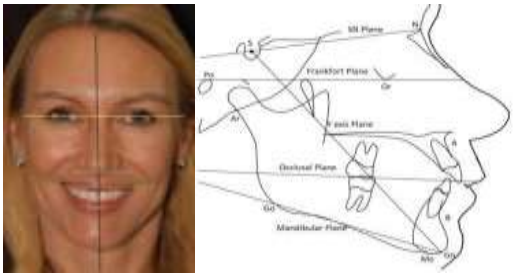

Fig 6

Any **FORM** can be created from the three basic shapes of a circle, triangle and square.[4](fig 7)

Fig7

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FACTORS OF ESTHETIC DENTOFACIAL COMPOSITION

A. Facial components
B. Dental components
C. Gingival components
D. Physical components

FACIAL COMPONENTS:

1) **References:**

a. **Horizontal** references
- Interpupillary line
- Ophriac line
- Commissural line

b. **Vertical** references:
- Facial midline

c. **Sagittal** references:

Upper and lower lip contour E-liners
- Upper lip should be 1-2mm behind the E-line
- Lower lip should be 2-3mm behind the E-line[5](fig 8)

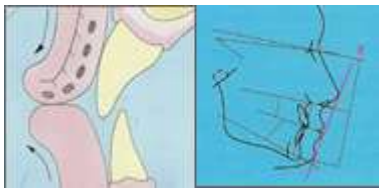

Fig 8

d. **Phonetic** references:

"**M**" sound: amount of incisal display at rest.
"**F**" or "**V**" sounds: lingual tilt of the maxillary central incisorlength.
"**S**" and "**Z**" sounds: vertical dimension of speech.(fig 9)

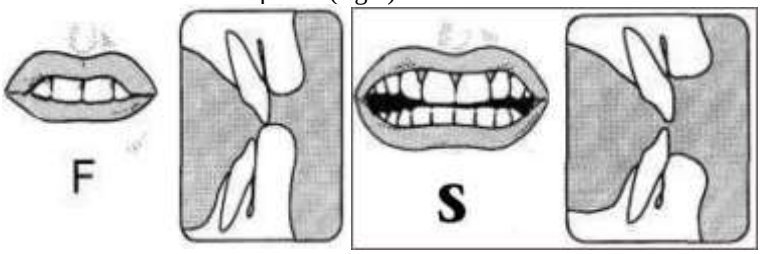

Fig 9

3. **Visibility:**

The amount of tooth exposure when lips part slightly in a relative rest state governed by muscles.
Younger: Short upper lips: upper incisors
Older: Long upper lips: lower incisors (fig 10)

Fig 10

Components of the Smile

a. **Lip line :**

Upper lip line:
- Exposure of teeth at rest/smiling and gingival margins on smiling.
- Evaluate the need for aesthetic gingival contouring/crown lengthening in anterior area.

International Journal Dental and Medical Sciences Research
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Fig 11

Lower lip line helps to evaluate buccolingual position of the incisal edge of the maxillary incisors and the curvature of the incisal plane.[6] (fig 11)

Incisal plane: In a youthful smile incisal edges of the central incisors and canines aligned on a convexity and are longer than the lateral incisors and incisal embrasures gradually deepens from the central incisors to the canines GULL WING appearance(fig12)

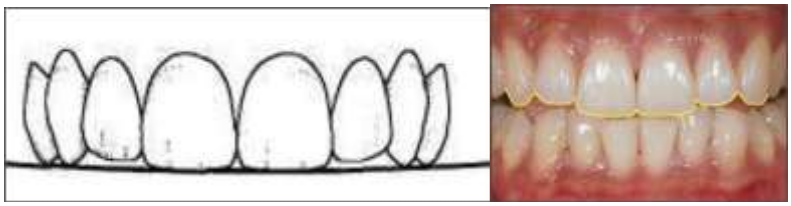

Fig 12

Smile line or incisal curve is composed of the incisal edges of the maxillary anterior teeth and parallels the inner curvature of the lower lip.

- Degree of curvature more pronouncedin women than in men.(fig 13)

Fig 13

Negative space: It is the dark space appearing between the jaws and the mouth opening either along the corners of the mouth or along the buccal aspect of the posterior teeth during the active smiling(fig 14)

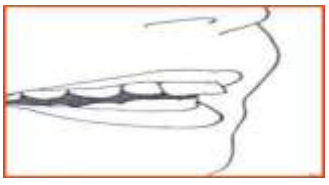

Fig 14

f. **Smile symmetry:**

- Perceived in reference to central midline.
- Horizontal and radiating symmetry.

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Volume 3, Issue 6, Nov-Dec 2021 pp 423-434 www.ijdmsrjournal.com ISSN: 2582-6018

• In a natural pleasing smile, pleasing tooth symmetry is found close to the midline and pleasing irregularity away from the midline, creating a balance between idealism and diversity.(fig 15)

Fig 14

DENTAL COMPONENTS:

1. **Dental midline :**

• Anatomical landmarks like the incisive papilla or the labial frenum.
• Balance and symmetry.

2. **Tooth proportion:**

• Golden proportion (61.8 %)
• Repeated ratio(fig 16)

Fig 16

Proportion and Ratios:

Golden Proportion: The Golden Proportion results from the division of a straight line in such a way that the shorter part is to the longer part as the longer part is to the whole. Each ratio equals 0.618.[7]

CB/AC = AC/AB = 0.618 (fig 17)

Fig 17

A/B = A+B/ C = C/B = B+C/A= 1.618 = phi

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Volume 3, Issue 6, Nov-Dec 2021 pp 423-434 www.ijdmsrjournal.com ISSN: 2582-6018

- Successive widths of the anterior teeth as viewed from the frontal aspect and this inclines that the width of the lateral incisor should be multiplied with the volume defined by the golden proportion which is approx. 0.618
- Ratio is - 1.618:1[7](fig 18)

Fig 18

Gradation:

Front-back progression: The essential requirement of the front to back progression in dental composition is the alignment of the contour of the labial surface at the incisal third, middle third and the gingival third of successive teeth in the arch.(fig 19)

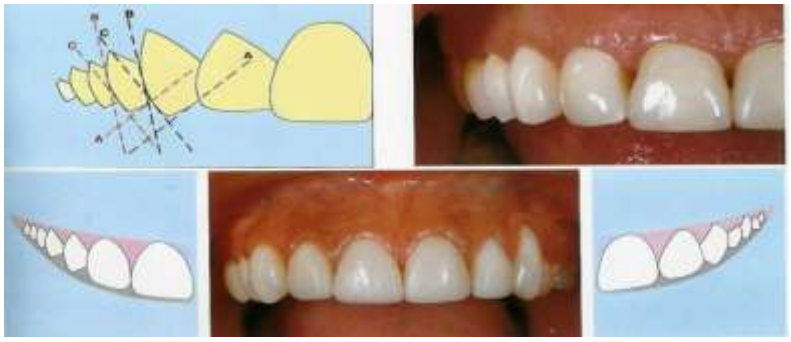

Fig 19

Axial inclination:

- It is the direction of the anterior teeth in relation to the central midline and becomes progressively more pronounced from the central incisor to the canine. There is a definite mesial inclination to all the anterior teeth related to the midline.
- The axes of the premolars and the first molar on either side also show mesial inclination in relation to the midline.

Deviations in axial inclination cause a visual tension when beyond the point of equilibrium.(fig 20)

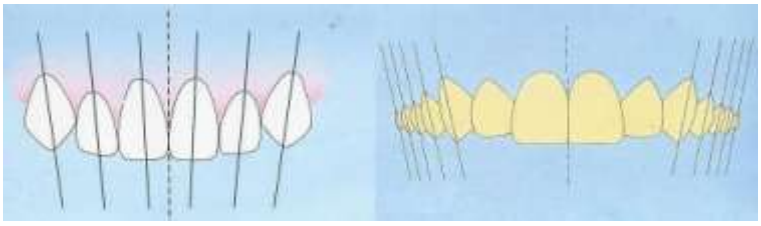

Fig 20

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Volume 3, Issue 6, Nov-Dec 2021 pp 423-434 www.ijdmsrjournal.com ISSN: 2582-6018

Teeth morphologyy:

a. **Contact area:**

b. **Texture :**

- Texture can be noted bythe light reflection pattern.
- The surface texture of a crown should simulatethe reflectance pattern of the adjacent natural teeth. (fig 21, 22)

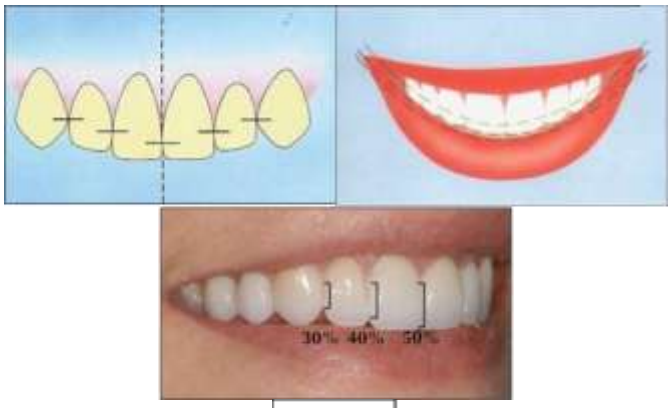


Fig 21

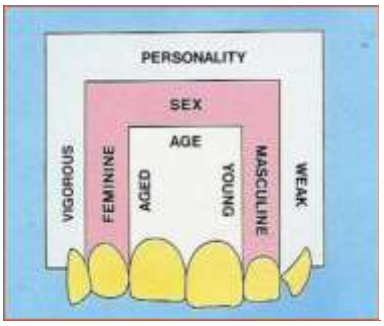
Fig 22

c. **Characterization :**

- According to age, sex and personality.

d. **Embrasure form:** facial, lingual, incisal and gingival embrasures.

- Affects perception:large embrasures make tooth appear smaller and vice versa.
- Incisal embrasures increase in size from central incisor to canine.(fig 23)



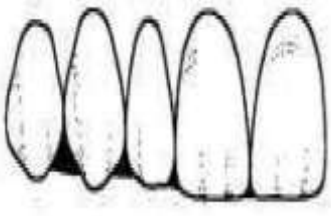


Fig 23

e. **Line angles:**

- Transition from the labial surface at themesial and distal lobes to the interproximal embrasures.

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• Changes in their positions controlthe appearance of the width of the tooth and affect light reflection pattern.

f. **Emergence Profile:**

• A tooth's emergence profile is the angle at which the tooth emerges from the gums when viewed from the side.(fig 24)

Fig 24

C. **GINGIVAL COMPONENTS:**

• Gingival line
• Gingival apex/zenith
• Gingival contour and scalloping
• Gingival embrasure
• Gingival symmetry[11](fig 25)

Fig 25

D. **PHYSICAL COMPONENTS:**

Perception:

Visual perception is:

• Increased by increasing contrast
• Increased by increasing light reflection
• Increased by decreasing light deflection

Illusion:

• Is theart of changing perception making an object appear different than it actually is.
• Solve/hide esthetically difficult situations.[8](fig 26)

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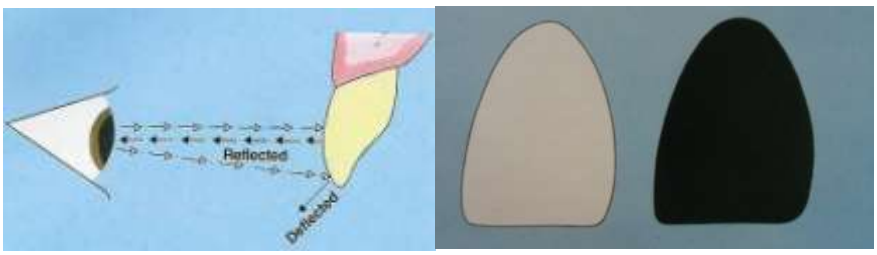

Fig 26

COLOR:

1. **BASE COLOR :**
   Base color is selected on the basis of hue, Chroma and value selection using shade guides and tabs, comparing with adjacent teeth.
2. **INTERPROXIMAL :**
   Interproximal color provides a silhouette for the tooth.
   Dark color makes teeth look smaller while no change in color will give a broader appearance.
3. **GINGIVAL THIRD :**

- Enamel gets thinner in the gingival third of teeth so darker dentin shows through and the area looks more yellow.
- Staining.

4. **INCISAL EDGE :**

- The incisal edge is translucent enamel resulting in translucency, a haloeffect, or no change as it is worn away with age.

5. **CHARACTERIZATION :**

- There are many different colors which can occur within a tooth as might be seen with craze lines or hypo calcifications.
- Staining.[8]

Guidelines for shade selection:

- Stains and deposits must be cleaned off the tooth, and the tooth must be kept wet throughout shade determination.
- Remove bright make-up like lipstick and use neutral-colored drape to avoid distraction.
- The teeth should be viewed at eye level so that most color-sensitive part of the retina will be used.
- The color of the luting agent must also be taken into consideration.[8]
- **Shade evaluation :**

✓ First visit after cleaning OR Next visit after tooth preparation or bleaching or a strenuous appointment, but following color stabilization.
✓ Under different lighting conditions and wet conditions.
✓ Hue, Chroma and value should be matched in that order.
✓ When in doubt, always select higher value and lower Chroma, since it is easy to lower the value and increase the Chroma.
✓ First impression of the chosen color is best and sometimes, squinting may help to choose the right value of color. (fig 27)

Shade tabs

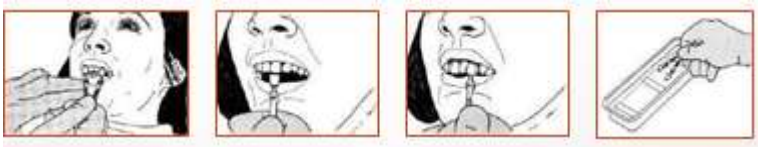

Fig 27

- Custom shade guides
- Photographs[8](fig 28)

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Fig 28

ESTHETIC CONSIDERATIONS FOR PONTICS(fig 29)

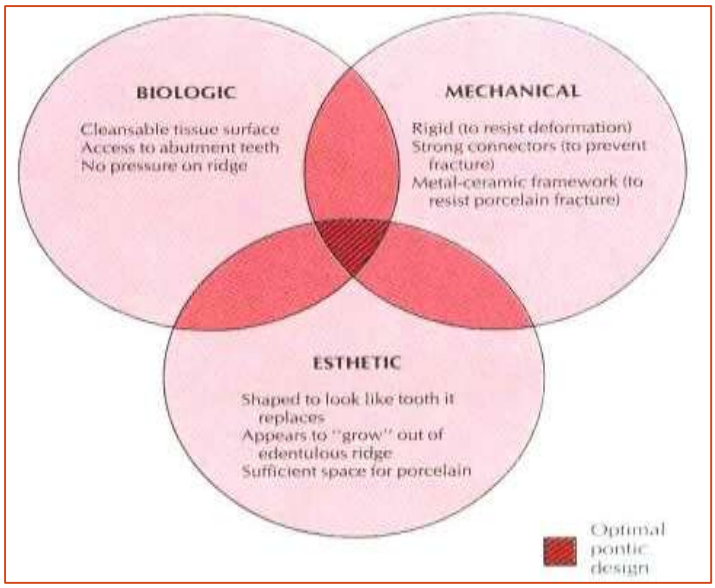

Fig 29

FACTORS AFFECTING PONTIC DESIGN

A. Pontic space
B. Residual ridge contour
C. Occlusal load (fig 30)

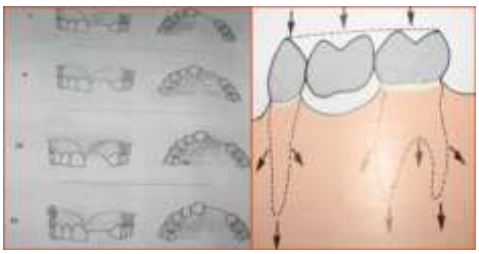

Fig 30

ESTHETIC PONTICS

- ❑ Saddle/Ridge lap pontic
- ❑ Modified ridge lap pontic
- ❑ Ovate pontic

ESTHETIC CONSIDERATIONS FOR CONNECTORS

Connectors are components of FPD that connect the pontic(s) to retainer(s).

-Rigid

-Non-rigid

A. Connector size
B. Connector shape
C. Connector position

TYPES OF ESTHETIC RESTORATIVE MATERIALS

1. Ceramic :
- Aluminous
- Feldspathic reinforced with Zirconia
- Feldspathic reinforced with Leucite
- Ceromers
2. Composite :
- Conventional
- Fibre-reinforced (glass, polyethylene, carbon)
3. Gingiva-colored materials:
- Ceramic like d.SIGN
- Acrylic
- Silicone

ESTHETIC FIXED RESTORATIONS INDICATIONS

- Missing teeth
- Crowding/Malaligned
- anteriors Mild rotations
- Stains/Discoloration
- Abrasions/Attrited anteriors
- Erosions/Destructed tooth
- Spacing
- Bridges
- Onlays
- Crowns
- Veneers/Laminates[12]

CONCLUSION

- It is a major challenge for a prosthodontist to restores the balance between function and esthetics and provides a treatment planning according to the knowledge of prosthetic limitations and esthetic outcomes.
- Longevity in fixed prosthodontics is not only dependent upon the precision and skill with which the work is carried out, but also to a large degree upon a proper assessment and diagnosis and the utilization and implementation of valid principles of design.[1]

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