牙體復形學 Operative dentistry

Esthetic Considerations in Diagnosis and Treatment Planning

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學習目標

- 期許同學在瞭解病患的需求及材料的特性後，能依據所學善加利用，做到不僅是幫病患解決病痛的牙醫師，同時也是個讓病患永遠也忘不了的藝術家。

1. 牙齒的生理，解剖形態
2. 齲齒的生理，診斷及治療計劃
3. 窩洞的修形及材料的選擇
4. 窩洞的充填方式及其修飾
5. 美觀性材料的選擇及其運用
6. 變色牙的修飾

參考資料

1. Sturdevant's art and science of operative dentistry. 4th edition. Theodore M. Roberson.
2. Fundamental of operative dentistry. A contemporary approach 3rd edition, James B. Summitt.

Summary

Operative dentistry is the basic science in clinical dental practices.It included dental physiology,morphology,cariology,tooth preparation for restoration.The purpose of Operative dentistry is to complete the function and create the aethestic outlook.

ESTHETIC PARAMETERS

Face Height

The face can be divided vertically into thirds, and the length of the middle third of the face should approximately equal the lower third of the face when measured in repose (Fig 3-1). The midface is measured from glabella, the most prominent point of the forehead between the eyebrows, to subnasale, the point below the base of the nose. The lower face is measured from subnasale to soft tissue menton, which is the lower border of the chin.

Face Height

Variations from tile norm can reflect a continuum from underdevelopment to hypertrophic development of either one or both arches. However, regarding esthetic diagnoses that impact dental treatment, excessive length of tine lower third of the face is most common. The long lower face is commonly the result of vertical maxillary excess and, in many cases, is accompanied by excess gingival display in the maxilla during full smile.

Lip Length

The length of the upper lip is measured from subnasale to the inferior border of the upper lip in repose (rest) (Fig 3-2a). The average length of the upper lip is 20 to 22 mm in the young adult female and 22 to 24 mm in the young adult male. The upper lip tends to lengthen with age. When a patient presents with excess gingival display (more than 2 mm of gingiva exposed above the maxillary central incisors during full smile), lip length may be part of the etiology (Fig 3-2b).

Lip Mobility

Mobility of the upper lip is measured from repose position to high smile position. The average lip mobility is 6 to 8 mm. In the patient with excess gingival display in full smile, hypermobility of the upper lip may be a contributing factor.

Symmetry

Outline symmetry is essential at the midline; the maxillary central incisors should be mirror images of each other. Additionally, a line drawn between the maxillary central incisors should be perpendicular to the horizon (Fig 3-3). Finally, the maxillary dental midline should be coincident with the facial midline. Asymmetry at the midline creates a visual tension in the observer resulting in an unacceptable esthetic presentation. As the eye moves peripherally from the midline, deviations from perfect symmetry (eg, notched edges or slight differences in edge lengths) become desirable.

Incisal Plane

The incisal plane should be parallel to the horizon; the interpupillary line is helpful in making this determination. The incisal plane is evaluated from cusp tip of the maxillary right canine to cusp tip of the maxillary left canine. Although the incisal plane must be parallel to the horizon, it is generally not flat, but has a curve that parallels the curve of the lower lip in full smile. In addition, it should not be canted up or down from right to left.

Incisal Plane

It is important not to perpetuate or create a canted incisal plane with restorations. If the interpupillary line is parallel to the horizon, the corners of the mouth should be pulled outward so that the upper lip parallels the interpupillary line (Fig 3-4). The relationship between the incisal plane and the interpupillary line, via the upper lip, can then be visualized. To transfer this information to an articulator, a facebow may be used, as long as the horizontal member of the facebow is made parallel to the horizon before attaching the bite fork. An incisal plane relationship bite may also be used. A bite registration paste is placed between the maxillary and mandibular incisors. A long cotton-tipped applicator is then embedded in the bite registration paste and set parallel to the horizon (Fig 3-5) This relationship bite can then be used to mount the maxillary cast with an accurate incisal plane orientation to the maxillary member of the articulator (Fig 3-6).

Posterior 0cclusal Plane

The buccal cusp tips of the maxillary posterior teeth should provide a visual progression from the canine cuwsp tips, with no step up or step down. In addition. The posterior occlusal plane should not be canted up or down from right to left. It is important not to perpetuate or create a canted posterior occlusal plane. The same techniques used to ensure an accurate mounting of the incisal plane are used for the posterior occlusal plane.

Buccal Corridor

The buccal corridor is the space between the buccal surfaces of the maxillary posterior teeth and the check. In full smile, the buccal corridor is almost filled with teeth. However, a minimal negative space frames the maxillary posterior teeth and is desirable. Excess buccal corridor space (Fig 3-7) is usually due to a developmental problem, ie, a constricted maxillary arch. Inadequate space in the buccal corridor is usually due to bulky posterior restorations.

Lower Lip

In full smile, the incisal edges of the maxillary anterior teeth are ideally cradled by tile lower lip (Figs 3-8a and 3-8b). Any space between the incisal edges and the lower lip should be minimal and uniform canine to canine (Fig 3-9) Conversely. none of the incisal edges of the maxillary anterior teeth should be concealed by the lower lip in full smile.

Lower Lip

If there is a reverse incisal edge curve in relation to the lower lip, or a significant space between the lower lip and the maxillary mesial edges during full smile, esthetics will probably be enhanced with increased incisal edge length. Conversely, if incisal edges of maxillary anterior teeth are hidden by the lower lip during full smile, there is likely a problem with the vertical position of the maxilla. The cause may be dentoalveolar extrusion (overeruption of maxillary anterior teeth) or vertical maxillary excess, or both.

Upper Lip

In full smile, tbe upper lip should ideally translate up to the gingival line (Fig 3-8b). This occurs in approximately 70% of the population. Approximately 10% have a high smile line, and approximately 20% have a Iow smile line. To evaluate the gingival line, a straight line is drawn from the tooth gingiva interface of the right maxillary canine The tooth-gingival interface of both central incisors should be on this line. The tooth-gingiva interface of the lateral incisors may either fall on the gingival line or be up to 1.5 mm below it (Fig 3-10)

Upper Lip

If the upper tip does nor translate up to the gingival line during full smile, some of tine clinical crowns of the maxillary anterior teeth remain covered. This results in a loss of dynamism of the smile, If, in full smile, the upper lip translates above the gingival line, this results in gingival display above the clinical crowns. Gingival display of 2 mm or more above the gingival line results in compromised esthetics.

Lip Asymmetry

If a patient displays an upper lip asymmetry during full smile (Fig 3-11), it does not influence treatment. However the patient should be advised of the condition before restoration of the maxillary anterior teeth, because the brighter restored maxillary anterior teeth will draw attention to the smile and accentuate the upper lip asymmetry.

Lip Asymmetry

If a patient has a lower lip asymmetry during full smile, which results in a unilateral increase in negative space between the maxillary incisal edges and the lower lip, smile symmetry is lost (see Fig 3-31b) When restoring maxillary anterior teeth in this circumstance, consideration is given to subtly lengthening the incisal edges on the affected side to minimize the unilateral asymmetry. This is first accomplished in a diagnostic waxup from which rovisional restorations are fabricated. The patient can then make the decision regarding the incisal edge configuration. Lip asymmetries, which can play a significant role in the final restorative result, are commonly overlooked.

Incisal Edge Placement of Maxillary Central Incisors

Determining the correct position of rile incisal edge of the maxillary central incisors is the first and an essential step in the provision of anterior restorative dentistry. The following five guidelines are used to determine the correct incisal edge position.

Incisal Edge Placement of Maxillary Central Incisors

1. In full smile, the incisal edges of the maxillary anterlor teeth should be cradled by the lower lip. (see Fig 3-8b).

Incisal Edge Placement of Maxillary Central Incisors

2. In full smile, the buccal cusp tips of the posterior maxillary teeth should provide a visual progression from the canine cusp tip, with no step up or step down (Figs 3-12 and 3-13)

Incisal Edge Placement of Maxillary Central Incisors

3. In gentle repose (have the patient say “M” or “Emma“), approximately 3 to 4 mm of the incisal edges of the maxillary central incisors are displayed in the young adult female (Fig 3-14). In the young adult male, approximately I to 2 mm of the incisal edges are displayed. After age 40, the amount of incisal edge display decreases approximately 1 mm per decade.

Incisal Edge Placement of Maxillary Central Incisors

4. When the patient says “E,” a space between the upper and lower lips is apparent (Fig 3-15a) If less than 50% of the space is occupied by the maxillary central incisors, the teeth can possibly be lengthened esthetically. If, however more than 70%, the space is occupied by the maxillary central incisors, lengthening of the maxillary anterior teeth will probably not be esthetically pleasing.

Incisal Edge Placement of Maxillary Central Incisors

5. When tile patient says 'F' or 'V,' tbe incisal edges of the maxillary central incisors should lightly touch the wet/dry border of the Iower lip: (Fig 3-15b)

Incisal Edge Placement of Maxillary Central Incisors

Steps I to 4 are used together to develop an approximation of the correct incisal edge position for the diagnostic waxup. At this point, incisal edge position is dictated strictly by esthetics. After tooth preparation, provisional restorations, which have been fabricated using the diagnostic waxup, are placed. The final incisal edge position is then developed dynamically, over time, in the provisional restorations to ensure suitable function and phonetics as well as esthetics. Step 5 is helpful in assessing phonetics with lengthened provisional restorations.

Facial Contour of Maxillary Incisors

Divide the facial surface of the maxillary central incisor into two planes. The gingival half of the tooth should be parallel to and continuous in contour with the surface of the gingival tissue overlying the alveolus (Fig 3-16). The incisal half is tapered back for ease in speaking and swallowing (Fig 3-17).

Facial Contour of Maxillary Incisors

Facial overcontouring of a partial- or full-coverage restoration in the gingival half can result in chronic gingival inflammation. Facial overcontouring in the incisal half can result in lip pressure, causing linguoversion of the overcontoured teeth or interference with the lip closure path.

Lingual Contour of Maxillary Incisors

Incorrect spacing between maxillary and mandibular anterior teeth may cause a lisp. A lisp can occur with too much or too little space, although, most commonly, it occurs with too little space.

Lingual Contour of Maxillary Incisors

If a patient develops a lisp after placement of provisional or definitive restorations, the position of the incisal edges of the mandibular incisors in relation to the maxillary central incisors when the patient makes an "S" sound must be determined. If the mandibular incisor approximates the cingulum or lingual concavity of the maxillary incisor, the lisp is most commonly corrected by increasing the lingual concavity of the maxillary incisors. If, however, the mandibular incisor approximates the incisal edge of the maxillary central incisor during the "S" sound, the lisp can most commonly be corrected by changing the length of the maxillary central incisors.

Gingival Zenith

The long axes of the maxillary anterior teeth are distally inclined. Therefore, the gingival contour adjacent to the maxillary incisors is not a symmetric rounded arch form. Rather, the marginal gingiva has a parabolic shape with the high point (gingival zenith) slightly distal to the midline of the tooth (Fig 3-18). In gingival recontouring surgery, the gingival zenith should not be overemphasized. Although a distalized zenith is more common, many patients prefer a more symmetric gingival architecture.

Interproximal Contact Areas

Maxillary interproximal contact areas become progressively more gingival from central incisor to canine (Fig 3-19). The interproximal contact between the maxillary central incisors is in the incisal third of the teeth. However, the interproximal contact between the central and lateral incisors is at the junction of the incisal and middle thirds; it is slightly more gingival between the lateral incisors and the canines.

Interproximal Contact Areas

If the interproximal contact extends too far incisally, a closed and unnatural-appearing incisal embrasure results. If the interproximal contact does not extend far enough gingivally, an open gingival embrasure, or black triangle, results.

Incisal Embrasures

The incisal embrasures increase from maxillary central incisor to canine (Fig 3-19). While the incisal embrasure between the maxillary central incisors is minimal, the incisal embrasure between the maxillary central and lateral incisors is more pronounced and between the lateral incisors and canines is the most pronounced. Uniform incisal embrasures, from maxillary canine to canine, are esthetically unnatural.

Maxillary Incisal Edge Configuration and Tooth Morphology

In nature, it is impossible to determine gender based on tooth shape or incisal edge relationships. However, tooth morphology and tooth-to-tooth relationships do convey information, albeit subjective, about the individual. In 1973, based on the writings of Frush and Fisher, Lombardi described relationships for fabricating complete dentures. His matrix is equally relevant for the dentulous patient today (Fig 3-20).

Maxillary Incisal Edge Configuration and Tooth Morphology

Using the Lombardi matrix, it is possible to characterize the teeth in the diagnostic waxup, the provisional restorations, and ultimately in tire definitive restorations.

Maxillary Incisal Edge Configuration and Tooth Morphology

Natural maxillary incisal edges, in a buccolingual direction, are not rounded but rather sharp. Due to wear, the incisofacial line angle in adults is relatively sharp and blends into a 1-mm lingual facet before dropping off to the concave lingual surface (Fig 3-21). Rounded maxillary incisal edges give the restoration an unnatural appearance due to the light reflection off a curved surface.

Mandibular Incisal Edge Shape

The incisal edge of the mandibular incisor should have a narrow, but defined, flat incisal table. This mesial table should be slightly canted facially. This is referred to as the pitch of the incisal table. The facial incisal line angle should be slightly beveled (Figs 3-23 and 3-24). This incisal edge configuration not only enhances esthetics but improves function. As the mandible moves forward, thc disclusion occurs efficiently on the leading incisofacial line angle of the mandibular incisor, rather than dragging on the broader facial surface.

Outline Symmetry

The distal surfaces of the maxillary central and lateral incisors, as well as the distoincisal line angles of these teeth, should be parallel (Fig 3-22). The outline symmetry of the maxillary central and lateral incisors should be similar. A large outline discrepancy (eg, a peg-shaped lateral incisor) negatively affects the beauty of the smile.

Facial Contour of the Maxillary Incisors

The facial surfaces of the maxillary incisors should not be rounded but rather flat with resulting bold mesial and distal line angles and deep facial embrasures (Fig 3-25). Restorations with rounded facial surfaces look unnatural; facial embrasures are not well defined, resulting in a lack of visual distinction of the maxillary anterior teeth.

Outline Form of Maxillary Canines

The distal half of the maxillary canine should not be visible when viewed from the fronts (Fig 3-26). As the eye moves laterally from the midline, each tooth should appear proportionately narrower than its mesial neighbor. This is termed the principle of gradation. After placement of porcelain restorations on the maxillary teeth, the most common offender of this principle is the canine tooth. It appears too wide ill relation to both the lateral incisor and the first premolar because the mesiodistal height of contour is too distal.

Outline Form of Maxillary Canines

Correct placement of the mesiodistal height of contour on the facial surface of canine restorations involves the skills of both the dentist and the laboratory technician. First, the dentist must remove sufficient tooth structure on the distofacial half of the tooth to allow the technician to create the correct facial contours. Second, the technician must visualize the case from the front during final contouring of the restorations to ensure that the principle of gradation is heeded.

Color

In dentistry, color is described in four dimensions. Hue is the basic color of the tooth and is usually in the yellow range. Chroma is the saturation or intensity of the hue. Value is a measure of the brightness of the tooth; a high-value tooth appears bright while a low value tooth appears darker. Finally, maverick colors are concentrated areas of color that are different from the overall background color.

Color

Natural teeth are polychromatic. They generally have higher chroma in the gingival third, transitionlng to a lower chroma and higher value in the middle third. The incisal third is characterized by the transition to incisal translucency, which is commonly framed by the halo effect (see Fig 3-22). Maverick colors can appear anywhere and individualize the tooth.

Color

The chroma of the maxillary lateral incisor is commonly the same as the central incisor; however, the value of the lateral incisor is commonly slightly lower. In the maxillary canine, the chroma is generally higher, especially in the gingival third, and the value is lower. Incisal translucency is usually minimal in the maxillary canine, and seldom does the halo effect occur. Polychromicity in the individual tooth and between neighboring teeth is essential in porcelain restorations if natural beauty is the goal.

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. Of these modifiers, skin color is by far the most important. 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.

Color Modifiers

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.

Image

The overall presentation of the smile can be described as the image. Miller discusses the differences between the "natural image" and the "media image." With the media image, the teeth are generally more symmetric, monochromatic, and very high in value. Tile natural image incorporates asymmetries, polychromicity, and lower value with higher chroma. Dentists commonly make esthetic choices for patients based on their own notions of beauty rather than on the patient's desires. When restoring maxillary anterior teeth, it is essential that the dentist understand the overall image that the patient desires.

Image

To maximize predictability when placing anterior restorations, the issue of overall smile presentation must be developed first, to the patient's satisfaction, in the provisional restorations.

Age Characteristics of Teeth

Both tooth color and surface texture relate information about the age of the patient (Figs 3-27 and 3-28).

Chroma and Value

The value, or brightness, of a tooth is higher in young patients and decreases with age. Conversely the chroma, or color saturation, is lower in young patients and increases with age.

Surface Texture

Surface texture is higher in the young patient and decreases as the patient ages. The surface luster is a function of the amount of surface texture. Therefore, the young tooth with high surface texture has a lower luster. As the surface texture is worn away with age, the surface luster increases. It is important to communicate with the laboratory technician about texture and luster. For example, porcelain veneers with Iow value, low surface texture, and high luster are not appropriate for a 25-year-old patient.

Individual Tooth Length and Proportion

The maxillary central incisor is the centerpiece of the smile. The average length of the maxillary central incisor is 10 to 11 mm (Figs 3- 29a to 3-29c). The ratio of height to width in the maxillary central incisor should be approximately 1.2 to 1.0. In other words, the width of the central incisor should be approximately 75% of its height. When evaluating a smile, the dentist must start with the position and size of the maxillary central incisor. It is difficult, if not impossible, to develop optinum esthetics with short maxillary anterior teeth.

Tooth-to-Tooth Proportions

The principle of gradation states that as the eye moves laterally from the midline, each tooth should appear proportionately narrower than its mesial neighbor. There has been much discussion about what this mesiodistal proportion should be. The golden proportion (1.618:1.0), which was formulated as one of Euclid's elements, has been proposed. Viewed from the front, the maxillary central incisor would be 1.618 times wider than the lateral incisor, the lateral incisor would be 1.618 times wider than the visual width of the canine, and so on as the eye moves distally.

Tooth-to-Tooth Proportions

However, developing esthetic proportions is not that simple. In a patient with a very tapered maxillary arch, the maxillary central incisors will appear wide, and the teeth may approximate the golden proportion. However, in a patient with a very square maxillary arch form, the golden proportion would result in unesthetically wide central incisors. To some degree, the width of the central incisor, in relation to the lateral incisor, is also a matter of personal taste.

Tooth-to-Tooth Proportions

The golden proportion produces very bold central incisors which appeals to some individuals. However, in natural teeth situated in natural arch forms, the golden proportion seldom occurs. The natural proportion of the width of the maxillary central incisor to the lateral incisor, when measured with a caliper, is approximately 1.2 to 1.0.7 The golden proportion is not based on actual tooth measurements, but on the tooth proportions when viewed from the front. This proportion is approximately 1.4 to 1.0 in nature (Figs 3-30a and 3-30b). Because dental esthetics is a matter of taste, the ultimate decision on widths and proportions must be developed in provisional restorations.

Principle of Illumination

Visually, there is the perception that light objects approach the viewer and dark objects recede from the viewer, This principle must be considered when high value porcelain or composite restorations are placed only on maxillary anterior teeth, because the result may be an unesthetic visual separation of tile anterior and posterior teeth. A visual coupling of the front and back of the mouth may require placement of restorations on one or more maxillary premolars (Figs 3-31a and 3-31b).

Law of the Tooth Face

The face of a tooth is that portion of the facial surface bound by transitional line angles when viewed from the front. To make teeth of dissimilar widths appear similar, the apparent faces should be made equal. To make an anterior tooth appear wider, the transitional facial line angles are moved into the interproximal facial embrasures. Conversely, to make an anterior tooth appear narrower, the transitional line angles are moved closer to the tooth midline (Figs 3-32a to 3-32d).

Conclusion

The provision of esthetic and functional restorative dentistry must be based on a set of guidelines founded on the best clinical science available. These guidelines can then be used to diagnose a patient's overall orofacial presentation and to guide the diagnostic waxup. Based on the diagnostic waxup, the provisional restorations are fabricated and placed. It is at this point that the "eye of the artist" becomes helpful for developing the final shade, shape, contour, and incisal edge configuration of the provisional restorations, which will serve as the blueprint for the final restorations.