CHAPTER 3

Patient Examination and Assessment

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INTRODUCTION

As indicated in Chapter 1, there is a wealth of evidence to support the popular notion that individuals with a more attractive outward physical appearance may have a distinct advantage over their peers from the point of view of improved social acceptability, occupational prospects and interpersonal relationships, and a sense of greater self-esteem and self-confidence.[1]

It has been suggested that the face is the most readily recognizable anatomical feature of the human body.[2] According to work by Goldstein,[3] the general public appear to perceive the mouth as the second most important feature after the eyes when considering facial esthetics.

The appearance of the smile is clearly an important factor in determining the attractiveness of a face.[1] An individual's smile is a key element of facial esthetics, and plays an important role in the non-verbal communication of many different sentiments, including friendliness, agreement and appreciation, and the conveying of emotions such as happiness, fear, sadness and surprise.[4]

It is hardly surprising, therefore, that the wish to improve one's smile – to enhance the appearance of the esthetic zone of the smile – may be the principal reason for an individual to seek dental care.[5] Such a wish may be reinforced by the ready access our patients have to information on contemporary esthetic treatment modalities such as tooth whitening, 'invisible' orthodontics, esthetic restorations, dental implants and other procedures, including the use of botulinum toxin and fillers to alter the appearance of the soft tissues of the face.

It is not so easy, however, to define the 'esthetic dental ideal', as the concepts of esthetics and beauty are so intimately related and vary within and between different cultures and ethnic and age groups. Beauty may be 'in the eye of the beholder' and is highly influenced by individual preferences and personal style and experiences. So-called 'subjective concepts in dental esthetics', however, cannot be relied upon to serve as effective guidelines for the planning of esthetic dental care.[6]

Practitioners must therefore have a clear understanding of what are often collectively termed the 'universal concepts of dental esthetics' when attempting to meet the demands placed on them by patients who are seeking enhanced dental esthetics.[6] Such universal concepts are based on generic perceptions of what is considered to be esthetically pleasing. They include:

- the elimination of disease and pathology
- the need to develop symmetry, proportion and harmony

- an appreciation of tooth position and dental morphology
- an appreciation of colour variations
- an appreciation of form.

Esthetic dentistry is a rapidly growing aspect of oral healthcare provision. According to survey data obtained by the American Academy of Cosmetic Dentistry (AACD), the mean revenue generated by dental practices in the USA from cosmetic procedures grew to $495,000 in 2007, representing a sizeable 15% increase over the previous year.[7] Notwithstanding subsequent growth in the esthetic dentistry market, there is a prospect of further growth well into the future. It is also important to take note of data reported by a major multinational indemnity group (Dental Protection Limited, UK), indicating that in 2011 there was a 50% increase since 2006 in the number of complaints involving smile makeover treatments, with cases reported to have been settled for five-figure sums, excluding legal costs.[8] Esthetic dentistry may be lucrative for dentists and lawyers but it is relatively high-risk in terms of patient complaints.

Medico-legal issues often arise as a consequence of incomplete or inadequate preoperative patient assessment and examination. In such circumstances, practitioners tend to have failed to appreciate, let alone fully understand, the patient's esthetic values, concerns and perceptions, and have taken it upon themselves to impose their interpretation of the smile best suited to the patient. As discussed below, the patient must always be involved in smile design decisions.

The aim of this chapter is to provide a comprehensive guide on how to assess and plan treatment for patients with concerns about their dental appearance; these concerns may range from a simple incisal edge fracture to the extreme of the patient who presents with an unsightly, dysfunctional, extensively restored and failing dentition. In all cases, a holistic approach to the care of the patient should be adopted. To achieve this, it is imperative for the practitioner to have a thorough working knowledge of the complex interplays between the dental hard tissues, the supporting alveolar and periodontal tissues, and the underlying occlusal scheme. For a satisfactory clinical outcome and a favourable prognosis to be obtained, the patient must have not just an esthetic smile, but also a stable occlusion, a good standard of oral health, and the necessary knowledge and skills to maintain his or her new dental status.

In the process of learning how to assess and plan treatment for a patient seeking esthetic dental care, it is hoped that the reader will develop an understanding of the concept of the 'esthetic ideal', founded on the evidence-based, universal principles of dental esthetics.

PATIENT HISTORY

The taking of a patient history should commence by recording essential data such as name, gender, date of birth, address and contact details, together with any information in respect of special needs when attending for dental care.

PRESENTING COMPLAINTS AND CONCERNS

The goals of esthetic dental care include the need to:

- meet the realistic expectations of the patient
- attain long-term functional and esthetic stability
- achieve the treatment goals through the application of minimal intervention approaches.

In order to begin to fulfil these goals, a comprehensive and contemporaneous patient history must be carefully obtained and appropriately documented. Above all else, it is of paramount importance that the practitioner listens attentively to the complaints and concerns of the patient, and complements the proposed history and examination procedure as necessary, so that all the issues raised by the patient are fully investigated. Treatment planning should not be commenced until such time as all investigations and related enquiries have been completed.

CLINICAL TIP

Spend sufficient time finding out why your patient is seeking esthetic change.

According to Chalifoux,[9] there are three categories of 'dental esthetic imperfections' that encourage patients to seek esthetic intervention. These relate to anomalies in tooth:

- colour
- position
- shape.

Esthetic imperfections in colour may be caused by, amongst other factors, the presence of stains, craze lines, dentine exposure, discoloration of residual tooth tissue by pre-existing and existing restorations, and alterations in the optical

properties of the remaining tooth tissues associated with ageing and wear, together with tooth discoloration associated with dental caries and loss of vitality of the tooth.[10] An example of a patient who presented with discoloured maxillary central incisor teeth is illustrated in Figure 3.1. The discoloration was multifactorial, including that acquired from the presence of stained restorations with secondary caries and leakage. While many practitioners would, in all probability, consider the defective restorations, possibly together with the incisor crowding, to be the most likely causes of the patient's esthetic concerns, careful assessment revealed that it was actually the relatively trivial circular area of white opacity present in the incisal third region of the upper right central incisor (UR1) that was causing dissatisfaction, highlighting an obvious difference in perception between the patient and the dentist.

Positional concerns may be associated with the presence of dental diastema, rotations and tipping of teeth, crowding, supra-eruption or intrusion, anomalies in arch shape and size, and, of course, loss or absence of teeth from the dental arch.[9] Unilateral positional anomalies that adversely affect symmetry tend to give rise to more esthetic concerns than bilateral anomalies, particularly if the bilateral anomalies are symmetrical.

Morphological anomalies that may be associated with esthetic concerns include the presence of fractures, cracks, tooth wear – abrasion, abfraction, attrition and erosion, dental caries, surface defects such as hypoplasia, and variations in surface texture that may vary from limited to severe, as may be seen in patients with congenital conditions such as amelogenesis imperfecta.[10] Other congenital anomalies that may contribute to esthetic dissatisfaction include unusual crown dimensions – macrodontia and microdontia, and variations in root diameter dimensions. Congenital malformations of the teeth, including peg shape, dilacerations, fusions and germination, are further examples of morphological anomalies that may give rise to esthetic concerns.[10]

In addition, as our patients become more conscious of and educated about facial enhancement treatments, which dental practitioners are increasingly providing, it is not uncommon for people to present with issues relating to facial esthetics.

It is often very helpful initially to ask those who are seeking esthetic treatment to fill out an esthetic evaluation form, designed to gain information and insight into a patient's personal perceptions concerning their dental and facial esthetics. An example of such a questionnaire, as used by Jornung and Fardal,[11] is reproduced in Table 3.1. This uses a 100 mm visual analogue scale (VAS) on

Fig. 3.1 Imperfections in colour. A. The case of a 69-year-old female patient, whose primary dental esthetic concern related to the white circular discoloration present in the incisal third of her upper right central incisor. B. Appearance following restoration with a bonded-resin composite.

TABLE 3.1 QUESTIONNAIRE USED TO RECORD PATIENT PERCEPTIONS OF AND OPINIONS ABOUT DENTAL AND FACIAL AESTHETICS*

Question	Visual analogue scale
Section 1	
How pleased/satisfied are you with your smile? Please indicate along the neighbouring line	|----------| Not pleased Very pleased
How pleased/satisfied are you with the shape of your lips?	|----------|
How pleased/satisfied are you with the shade (whiteness) of your teeth?	|----------|
How pleased/satisfied are you with the evenness of your teeth?	|----------|
How pleased/satisfied are you with the looks of your gums?	|----------|
Are you aware of having receding gums? Please circle	Yes / No
If you have answered yes, how much does it affect your smile? Please indicate along the neighbouring line	|----------| (Not at all) (Very much affected)
Do you have crooked teeth? Please circle	Yes / No
If you have answered yes, how interested are you in having orthodontic treatment to correct the crooked teeth?	|----------| (Not interested) (Very interested)
Section 2	
How important are the following features for an attractive face? Please indicate along the neighbouring line in each case	|----------|
Hair	(Not important) (Very important)
Hairline	|----------|
Eyes	|----------|
Eyebrows	|----------|

TABLE 3.1 ***Continued***

Question	Visual analogue scale
Nose	|----------|
Skin	|----------|
Ears	|----------|
Lips	|----------|
Teeth	|----------|
Chin	|----------|
Shape of head	|----------|

*Modified from Jornung and Fardal.[11]

which patients can record their perceptions according to statements relating to their dental–facial esthetics; the scale ranges from 0 to 100, indicating 'not pleased' to 'very pleased'.

The answers provided to these questions not only may help guide the clinician as to how best to satisfy the needs and expectations of the patient, but also may aid in the identification of possible underlying psychological conditions, such as body dysmorphic disorder (BDD), which may have profound medico-legal implications, as discussed below.

A detailed history of the problem should also be recorded, as it may reveal underlying conditions and pathology that may require treatment and subsequent stabilization prior to addressing the esthetic concerns. In the view of the authors, diseased tissues and structures are always considered to be unsightly. As a prerequisite to predictable esthetic treatment, any existing disease should be managed and the condition stabilized.

MEDICAL HISTORY

A detailed medical history must be obtained and recorded. The use of a template medical history form may help avoid critical omissions.

In the provision of esthetic dental care, patients' medical history and status may:

- prevent them from attending any lengthy or frequent treatment sessions that are needed

- necessitate a modification of the treatment protocol to take account of an underlying medical condition or the drugs used to treat it
- contraindicate certain types of treatment: for example, an allergy to a material or product that prevents its use
- contribute to the esthetic impairment: for example, the taking of prescription medication that may induce gingival hyperplasia, or an eating disorder, hiatus hernia or gastric reflux resulting in erosive tooth wear.

It is beyond the scope of this chapter to discuss the plethora of medical conditions that may potentially impact on the delivery of esthetic dental care. However, one condition that warrants further discussion is BDD.

BDD may be considered to be a psychiatric illness that is characterized by a preoccupation with an imagined defect in appearance; this in turn causes marked distress to the affected person. This preoccupation may cause clinically significant distress or impairment in social functioning, occupation or other important areas, with the preoccupation not being related to any other form of mental illnesses.[12] Whilst BDD has been reported to have an incidence rate of approximately 3% amongst the general population, it would appear to be more common amongst those seeking cosmetic and esthetic treatments. This is covered in detail in Volume 2 of this series as part of patient assessment.

Typical features of patients suffering from BDD include:

- onset in late adolescence
- equal prevalence amongst males and females, although unmarried individuals appear to be more susceptible[13]
- a reluctance on the part of patients to disclose their symptoms
- social phobias and obsessive–compulsive disorders (OCDs), which are common amongst sufferers
- a tendency towards alcohol dependency
- a tendency to become housebound
- suicidal tendencies.

Patients suffering from BDD appear to be most preoccupied with esthetic impairments relating to their skin, hair and nose. Indeed, a high proportion of sufferers reportedly seek cosmetic surgery involving their chins and noses. Details of such surgical intervention should be recorded as part of the medical history, which may ultimately help with diagnosis of the condition.

Clearly, patients suffering from BDD may be profoundly challenging to treat. When the dental practitioner observes behaviour that may be suggestive of BDD, referral to the patient's medical practitioner is advisable prior to considering any form of esthetic dental care, in particular any form of invasive, irreversible treatment.

DENTAL AND SOCIAL HISTORY

The patient's attitudes towards dentistry and oral health should be assessed. Oral hygiene habits, past attendance habits and previous experience of dental care should also be established. Dental phobic patients and those who lack the motivation to maintain a high standard of oral hygiene may be more suited to relatively simple, low-maintenance, minimally invasive forms of treatment that help address their concerns. Those with unrealistic expectations may require further counselling, especially prior to embarking upon complex, irreversible forms of dental treatment.

The patient's social habits, such as smoking and levels of alcohol consumption, should be ascertained. Smoking and excessive alcohol consumption not only contribute towards the initiation and progression of various forms of oral disease, but also may contraindicate certain forms of treatment, such as tooth whitening and implant therapy. The copious and frequent consumption of foods and beverages that may cause staining, including tea, coffee, red wine and turmeric, are further factors to be considered when contemplating colour-enhancing treatments such as tooth whitening.

The patient's occupation should also be noted, as it may affect their ability to attend on a frequent basis, or indeed may have an aetiological role in the causation of their esthetic concerns.

Finally, a dietary history should be obtained, taking particular note of the frequency and quantity of refined carbohydrate intakes, together with the consumption of acidic foods and drinks in the diet.

PATIENT EXAMINATION

For any given clinical condition, the reaching of a definitive diagnosis (or diagnoses) and the development of an appropriate treatment plan are primarily dependent on a meticulous patient examination. The protocols for the examination of a patient attending in the primary dental care setting are well rehearsed, and indeed form a large part of the daily routine of the practitioner.

CLINICAL TIP

Allocate a longer appointment time for your patient examination than you think you will need. This will also allow for more time to be spent on patient communication.

As many more people are seeking esthetic dental care, it should perhaps become a matter of routine to undertake a detailed dento-facial esthetic assessment of every patient, in particular those attending a practice for the very first time. This would augment the wealth of baseline information commonly acquired and provide the patient and dentist with a background understanding for any discussions pertaining to esthetic issues. A history of multiple facial esthetic procedures may alert the practitioner to the possible presence of BDD.

A patient assessment form is a particularly useful tool to help avoid any key omissions. The form advocated by the authors is reproduced in Box 3.1.

EXTRAORAL EXAMINATION

The extraoral examination should include an assessment of:

- temporomandibular joints, associated musculature and cervical lymph nodes
- facial features: facial proportions, facial symmetry, facial profile, facial shape and width
- lips: morphology and mobility
- facial skin.

The temporomandibular joints, masticatory musculature and cervical lymph nodes

The temporomandibular joints should be examined bilaterally for the presence of:

- any tenderness or pain elicited upon palpitation of the area anterior to the auricular tragi or intra-auricularly
- asynchronous movement upon mandibular opening and closure
- mandibular deviation upon opening and closure
- clicking sounds: clicks may be detected early, middle or late on opening and/or during closure
- any grating sounds, crepitation or joint locking.

BOX 3.1

TEMPLATE CHECKLIST FOR PATIENT ASSESSMENT

Personal details

- Name
- Gender
- Date of birth
- Address/contact details

Presenting complaint

- History
- Concerns

Medical history

Past dental history

- Last dental visit
- Frequency of dental attendance

Social history

- Occupation
- Habits
- Dietary preferences

Extraoral examination

- Facial asymmetry
- Facial shape
- Lymphadenopathy
- Skeletal pattern
- Temporomandibular joints
- Occlusal face height
- Resting face height
- Freeway space
- Maximal vertical opening
- Smile analysis
- Lip profile

Intraoral examination

- Soft tissues
- Muscles
- Periodontal tissues
- Existing dental charting
- Static and dynamic occlusal assessment

The use of a stethoscope may be helpful when undertaking auscultation of the joints.

The degree of maximum mandibular opening should also be determined by measuring the inter-incisal distance. Any distance of less than 35 mm is considered to be restricted. The degree of maximum lateral movement should also be determined; the normal is accepted to be about 12 mm.

Palpation of the masticatory muscles should also be undertaken. This is best accomplished by simultaneous, bilateral palpation to permit comparisons between contralateral muscles for the presence of tenderness or discomfort. Of particular importance are the anterior and posterior elements of the temporalis muscles and the superficial and deep elements of the masseter muscles. The practitioner, however, may also wish to assess the anterior digastric, sternomastoid, trapezius, and medial and lateral pterygoid muscles.

The cervical lymph nodes should be palpated, and the presence of any enlargements or tenderness documented and, where indicated clinically, investigated.

Facial features

Consensus opinion appears to suggest that there are certain proportions that are perceived to be visually pleasing.[14] Accordingly, when undertaking a smile assessment, it is important to record the extent of harmony and disharmony that exists between the facial structures and the dento-facial composition. Disharmony may require some form of intervention to create harmony; however, such interventions may change the character of the face, contrary to the wishes of the patient. Facial assessment must, therefore, be both comprehensive and careful.

The features that should be included in the facial assessment are:

- vertical facial proportions
- facial symmetry
- facial profile
- facial shape and width.

Facial proportions

In general, when viewed from a frontal direction and with the patient adopting a natural pose, the face can be divided into three distinct zones: the ‘upper third’, which encompasses the area between the hairline or forehead and the

Fig. 3.2 Facial regions. The zones delineated by the vertical black lines represent the three regions into which the human face can be subdivided (upper, middle and lower thirds) when viewed from the front.

orphic line, commonly termed the brow line; the 'middle third', which spans the space between the orphic line and the inter-alar line at the base of the nose; and, the 'lower third', which includes the area between the inter-alar line and the tip of the chin. These zones are shown diagrammatically in Figure 3.2.

According to Fradeani,[15] in a well-proportioned face the three zones have similar dimensions. Dissimilarities in dimensions between the three zones, which are common, may not, however, give rise to esthetic concerns. It is generally agreed that the lower third of the face tends to determine overall facial appearance. It also happens to be the zone over which dental practitioners have most control.

When undertaking a prosthodontic rehabilitation, the practitioner should aim to subdivide the zone constituting the lower third of the face into three sections, such that the upper section is occupied by the upper lip and the lower two-thirds by the lower lip and chin.[16] This may be a useful guide when planning treatment for patients who have lost occlusal vertical height as a result of pathological tooth wear.

Facial symmetry

The facial midline and the inter-pupillary line are the vertical and horizontal reference planes employed most commonly to assess facial symmetry (Fig. 3.3). The use of a wooden spatula and a Fox's bite plane can be helpful in examining the patient for facial and dental symmetry.

It is generally accepted that esthetic harmony exists when the vertical and horizontal reference planes are perpendicular to each other, and the dental midline is co-incident with the facial midline, forming a pleasing smile.[15] Whilst it has been shown that patients can readily detect the presence of any disparity between the dental and facial midlines,[4] a more recent study by Johnston et al.[17] has demonstrated that the presence of a discrepancy of less than 2.0 mm between the facial and dental midlines may be considered to be esthetically acceptable. Accordingly, it was concluded that restorative or orthodontic intervention should, wherever possible, aim to leave the dental midline within 2.0 mm of the facial midline.

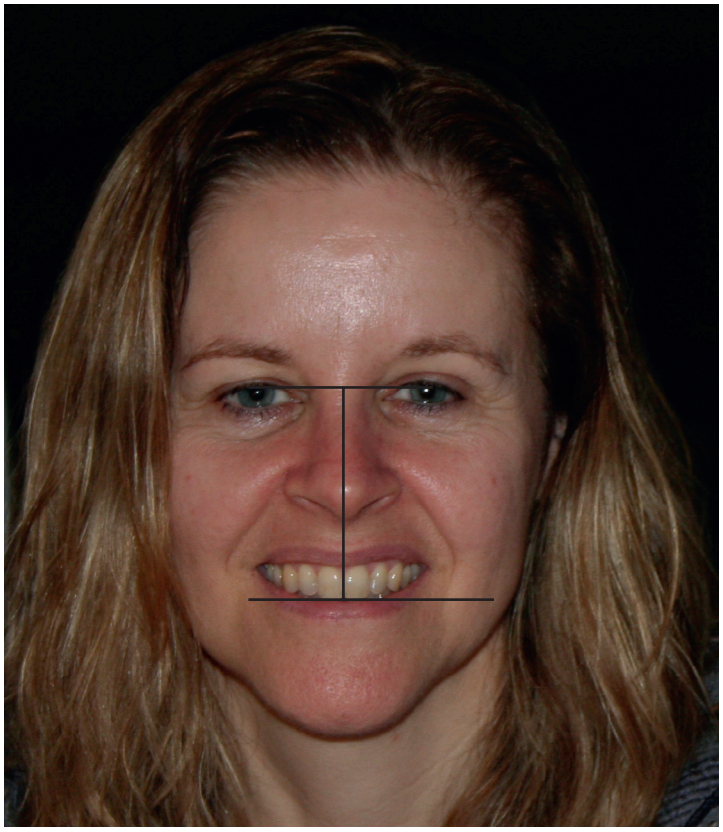

Fig. 3.3 Facial symmetry. The facial midline is determined by an imaginary line between nasion and the middle of the base of the philtrum. The inter-pupillary line is the most commonly applied horizontal reference plane when assessing facial symmetry.

The inter-pupillary line provides the operator with a key reference axis in determining the position of the incisal, gingival and occlusal planes. Traditionally, when undertaking prosthodontic rehabilitation with complete dentures, it is advocated that the incisal edges of the maxillary anterior teeth are positioned parallel to the inter-pupillary line. This concept has been extrapolated to the scenario of planning fixed prosthodontic rehabilitation for the worn anterior dentition, in particular where the tooth surface loss has resulted in a canted incisal plane, as shown in Figure 3.4. However, caution needs to be exercised where the inter-pupillary line may be canted and angled relative to the horizon, with the eyes possibly not being at the same level. In such cases, the horizon is best applied as the most appropriate horizontal reference plane.[15]

Likewise, when assessing for vertical symmetry, it is not uncommon for the tip of the nose and the tip of the chin to be divergent from the facial midline. In such circumstances the centre of the upper lip may be used as the 'ideal reference point' for determining the facial midline.[15]

Fig. 3.4 A canted incisal plane in a patient with a worn anterior dentition.

Facial profile

The lateral facial profile is best assessed with the patient adopting a natural head posture. Some authors advocate the use of the Frankfort plane to verify the position of the head.

Three forms of facial profile are commonly described in the literature:

- normal profile
- convex profile
- concave profile.

An example of each is shown in Figure 3.5.

The 'profile angle', formed by connecting the glabella, subnasale and the soft tissue pogonion (tip of chin), may be used as a guide in determining the form of the facial profile.

It is thought that a profile angle of 165–175° corresponds to a normal (class I skeletal) profile.[18] In a convex-profile patient, the profile angle may be considerably reduced, resulting in a marked posterior divergence (often seen as a class II skeletal pattern). A profile angle in excess of 180° is most often seen in conjunction with class III skeletal patterns, with an associated marked anterior divergence. Whilst a small element of divergence may be acceptable, its absence is generally associated with esthetically pleasing facial proportions, good occlusion and superior dental esthetics.[15]

Variations in profile angles and facial profiles will not reveal which jaw is retruded or protruded; hence cephalometric analysis may be indicated.

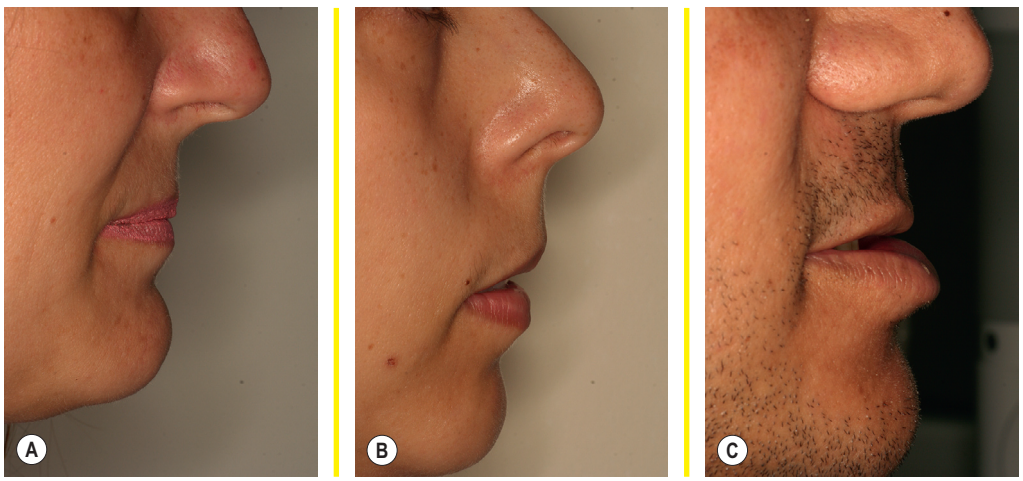

Fig. 3.5 Examples of the different facial profiles commonly observed. A. Normal profile. B. Convex profile. C. Concave profile.

The 'E-line', formed by connecting the tip of the nose to the tip of the chin, is also commonly applied in determining facial profile. A normal profile is thought to exist when the upper and lower lips are 4 mm and 2 mm posterior to the E-line, respectively.[19]

The naso-labial angle, formed by connecting the inferior nasal septum, subnasale and upper lip, can also be used to assess profile variations. Normal profiles are thought to be associated with angles in the range of 85–105°.

The application of any of the above guides in determining the lateral facial profile is subject to considerable racial variation, in particular amongst Asian–Oriental and Afro-Caribbean individuals, and between males and females. 'Normal range values' should be interpreted with caution.

It is important not to make dramatic changes to the E-line and naso-labial angles when undertaking orthodontic or prosthodontic care, as this may have a negative impact on the neutral zone formed by the equilibrium of pressures between the lips and cheeks externally and the tongue internally. Otherwise, the outcome may be an unstable arch form or prosthesis.

Facial shape and width

Traditionally, four different facial shapes have been described. Historically, these have been used with little, if any, scientific basis, to determine an appropriate tooth mould in removable denture construction. The four facial shapes are:

- ovoid
- square
- tapering
- square–tapering

In recent times, Ahmad[14] has described four typological categories to characterize a particular facial shape. These are:

- lymphatic – rounded full features with a timid personality
- sanguine – prominent thick, well-defined features associated with intransigence and spontaneity
- nervous – large forehead, thin delicate features with an anxious disposition
- bilious – rectangular and muscular features coupled with a dominant persona.

It has been suggested that the morphology of the teeth and any restorations should conform to these types.

Facial width may be crudely assessed as the width of 'five eyes'.[6]

Lips

It is important to assess lip morphology and mobility. A morphological description should take account of the width, fullness and symmetry of the lips. In general, wide lips are associated with a wide smile. A smile that is at least half the width of the face is considered to be esthetically pleasing.[6] The fullness of the lips may be described as being thin, medium or thick. Associations have been made between fullness and personality traits, which in turn may influence tooth morphology, as discussed above.

Full lips, in particular when found in a concave facial profile, are often associated with dominance of the maxillary central incisors in the esthetic zone. In contrast, a convex profile with thin lips is often associated with moderate dominance of the maxillary anterior teeth. Fullness and symmetry should be assessed across the midline. Lack of symmetry may have a significant influence on the incisal plane, which the practitioner may opt to cant slightly to mimic the asymmetrical lip profile.

Lip mobility refers to the amount of lip movement that occurs when a patient smiles. The amount of anterior tooth display should be assessed with the lips at rest and in dynamic positions. The rest position of the lips has classically been used to determine the position of the incisal edges of the anterior maxillary teeth when undertaking complete denture prosthetics. Vig and Brundo[20] determined the average ranges for tooth display at rest, according to age:

- aged 30 years: 3.0–3.5 mm
- aged 50 years: 1.0–1.5 mm
- aged 70 years: 0.0–0.5 mm.

These values may serve as a useful guide, particularly when contemplating the lengthening of the incisal edges by means of fixed prosthodontics.

As part of age-related alterations of the facial profile, changes occur to the lips, resulting in reduced tooth display in the rest position. This may be accentuated by tooth wear.

Phonetic tests, such as the enunciation of the 'F' and 'V' sounds, can help to verify the correct spatial relationship between the incisal edges of the anterior maxillary teeth and the lower lip. The length of the philtrum should be measured. In general, philtrum height should be 2–3 mm shorter than the height of the commissures. Younger patients often have a shorter philtrum height.

The mobility of the upper lip will determine the extent of the maxillary teeth and associated gingival tissue displayed on smiling, whilst the curvature of the lower lip, as discussed below, can serve as a useful guide for the arrangement of the maxillary incisal edges.

Facial skin

An assessment of the facial skin should be carried out on a routine basis, in particular when facial esthetic treatments may be indicated. Skin types may be classified according to pigmentation, tendency to burn, and likelihood of reaction to treatment, in particular heat-based treatments such as lasers. The Fitzpatrick skin phototype classification[21] provides a particularly useful way of looking at skin types to assist with treatment planning, where certain skin types, such as those of the thin, transparent variety (category 1), are less suited to dermal filler therapies. In such situations, there is a risk of developing a green/yellow discoloration if fillers are injected superficially.

The presence and distribution of skin wrinkles may also be noted, both at rest and during dynamic movements. The Glogau index[22] can provide a particularly useful tool for categorizing skin wrinkles and for quantifying improvement following treatment. This index also provides a platform for planning future re-treatments.

INTRAORAL EXAMINATION

A thorough intraoral examination should be conducted in a systematic manner. It should include an assessment of:

- soft tissues
- periodontal tissues
- dental hard tissues
- occlusion and arch form
- esthetic zone
- edentulous spaces, if any.

Soft tissues

The soft tissues of the lips, cheeks, tongue, vestibule, soft palate, hard palate and floor of the mouth should be meticulously examined for the presence of any anomalies. When present, any anomaly should be carefully described and recorded; if required, the patient should be referred for a specialist opinion. The presence of a tongue thrust or high frenal attachments should be noted.

Periodontal tissues

It is of paramount importance that signs of periodontal tissue pathology are successfully managed prior to embarking upon any form of esthetic dental treatment. It is therefore critical to assess the periodontal tissues for the presence of any disease and to determine the patient's standard of oral care. The potential impact of any restorative intervention on the periodontal tissues must also be considered. Dental restorations must be planned and designed to ensure that they are conducive to maintaining good periodontal health. This may, however, be difficult to achieve. By way of example, almost all ceramic veneers induce gingivitis to some, albeit very limited, extent; thus, a high level of oral hygiene should be a preoperative requisite.

The patient's overall standard of oral hygiene should be documented as being good, moderate or poor. The presence and extent of any plaque and calculus deposits should also be described and recorded. Any local factors that may encourage plaque and calculus accumulation and stagnation should also be determined, including overhangs and other defects in restorations. The presence and extent of extrinsic tooth stains should be noted.

The gingival tissues should be examined for the presence of any inflammatory changes, including erythema, swelling, loss of stippling, blunting of the gingival papillae, bleeding on probing and the presence of any exudates.

A basic periodontal examination (BPE) should be conducted on a routine basis.[23] Where a score of '3' is recorded for two or more sextants, a full-depth, six-point periodontal charting may be indicated. It may also be important to document the levels of attachment to determine the amount of periodontal destruction and recession that has occurred. This is achieved by measuring the distance between the most apical extent to which the periodontal probe may be placed and a fixed reference point, usually the cemento-enamel junction (CEJ).

Other periodontal features to note include:

- the presence of any tooth mobility
- furcation involvement
- bleeding on probing – immediate or late
- plaque scores.

Details of how to perform an esthetic assessment of the gingival tissues are discussed in more detail below.

Dental hard tissues

Accurate charting should aim to record the presence and absence of teeth, dental caries, sound and defective restorations, tooth fractures, cracks, wear of abrasive, erosive, abfractive and attritional varieties, and any tooth malformations.

The extent and location of any caries should be noted, as should the type and extent of all dental restorations present. Dental restorations should be further assessed for their marginal integrity and adaptation, structural integrity, form, function and esthetic appearance. The presence of any secondary caries, open contacts and other food traps and wear facets, present on either the remaining dental tissues or the functional surfaces, should be documented.

Occlusion and arch form

It is important to carry out a detailed occlusal assessment to establish the ways in which the patient's occlusal scheme differs from what may be considered to be the ideal – a mutually protected occlusal scheme[24] – and to determine the constraints the occlusal scheme may place on fulfilling the patient's esthetic expectations. One of the key aims of whatever treatment may be provided is to ensure a functionally stable dentition. The occlusion should be assessed in both static and dynamic positions.

Static occlusal examination

The static occlusal examination should seek to identify the presence of any of the following features:

- tooth rotations, tilting, drifting and supra-eruption
- crowding
- spacing, including the presence of any diastema

- abnormal overjet and overbite, including open bites and cross-bites
- atypical occlusal vertical dimension – freeway space (FWS)
- atypical arch form and relationships.

Assessment of these features will help to elicit the nature of any malocclusion.

The inter-arch occlusal relationship may be qualified by information on incisor, canine and molar segment relationships. In general, in an incisor class I case, in which the incisal edges of the mandibular incisors occlude or lie directly below the cingulum plateau of the maxillary anterior incisors, both the overjet and overbite should have a value of 2–4 mm.[25] The class I incisor relationship is considered to be the functional ideal.

An FWS assessment should be undertaken, particularly when the patient presents with a worn dentition. A plethora of different methods have been described to determine the FWS; however, a Willis gauge is widely used to measure the difference between the resting vertical dimension (RVD) and occlusal vertical dimension (OVD), as shown in Figure 3.6.

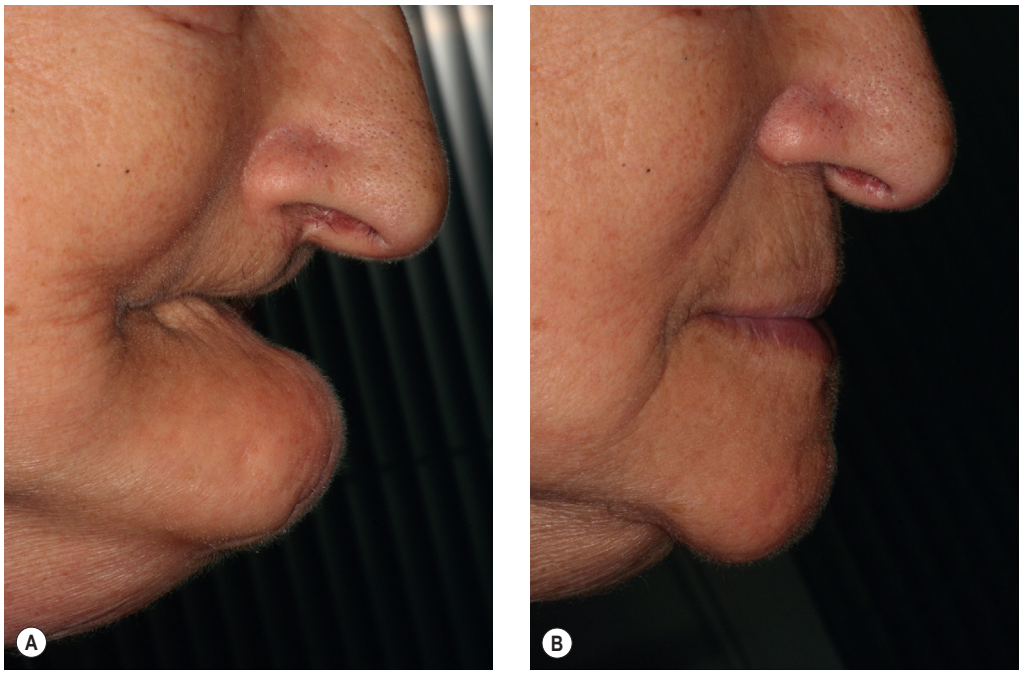

Fig. 3.6 Assessing the freeway space. A. 'Overclosed' appearance with a reduced occlusal vertical dimension. B. The resting vertical dimension.

Dynamic occlusal examination

The dynamic occlusal examination should first establish the inter-cuspal position (ICP), also commonly referred to as the maximal inter-cuspal position (MIP) or centric occlusion (CO). It is generally accepted that when a limited number of restorations are being undertaken, which may involve some minor modifications to the anatomy of the occlusal table, the occlusal endpoint should conform to the existing ICP, unless the ICP is unstable. Signs of occlusal instability include:

- mobility of teeth and fremitus
- atypical and pathological wear of teeth
- tooth fractures and chipping
- fractured restorations
- localized periodontal bone loss and recession
- occlusal discomfort
- temporomandibular joint dysfunction (TMD).

The ease with which the mandible can be manipulated into its retruded arc of closure should also be assessed. If the patient has established protective neuromuscular reflexes, this may be difficult. The use of a muscle-deprogramming device, such as a wooden tongue spatula, cotton wool rolls or a Lucia jig, may be helpful. If deprogramming devices do not help resolve the difficulty, a full-coverage, hard-acrylic stabilization splint may be required to allow the retruded arc of closure and, in turn, the retruded contact point (RCP) and centric relation (CR) to be reproducibly identified. This is important when a reorganized approach is indicated in the management of the occlusion, with the aim of ICP and RCP being co-incident.

In the majority of patients there will be a limited (1.25 mm), typically horizontal slide between RCP and ICP. The presence and extent of such a slide should be documented. In the management of tooth wear cases, the space provided by the slide between RCP and ICP may be used to accommodate restorative materials without the need to change the patient's occlusal vertical dimension, as illustrated in Figure 3.7.

It is important to document the anterior guidance and note the teeth that provide it. The steepness of the anterior guidance should also be recorded as being steep, moderate or shallow.

The effects of possible alterations to the anterior guidance on the posterior occlusion must be carefully evaluated, especially in cases where the form and function of the anterior teeth may be changed. Ideally, the anterior guidance

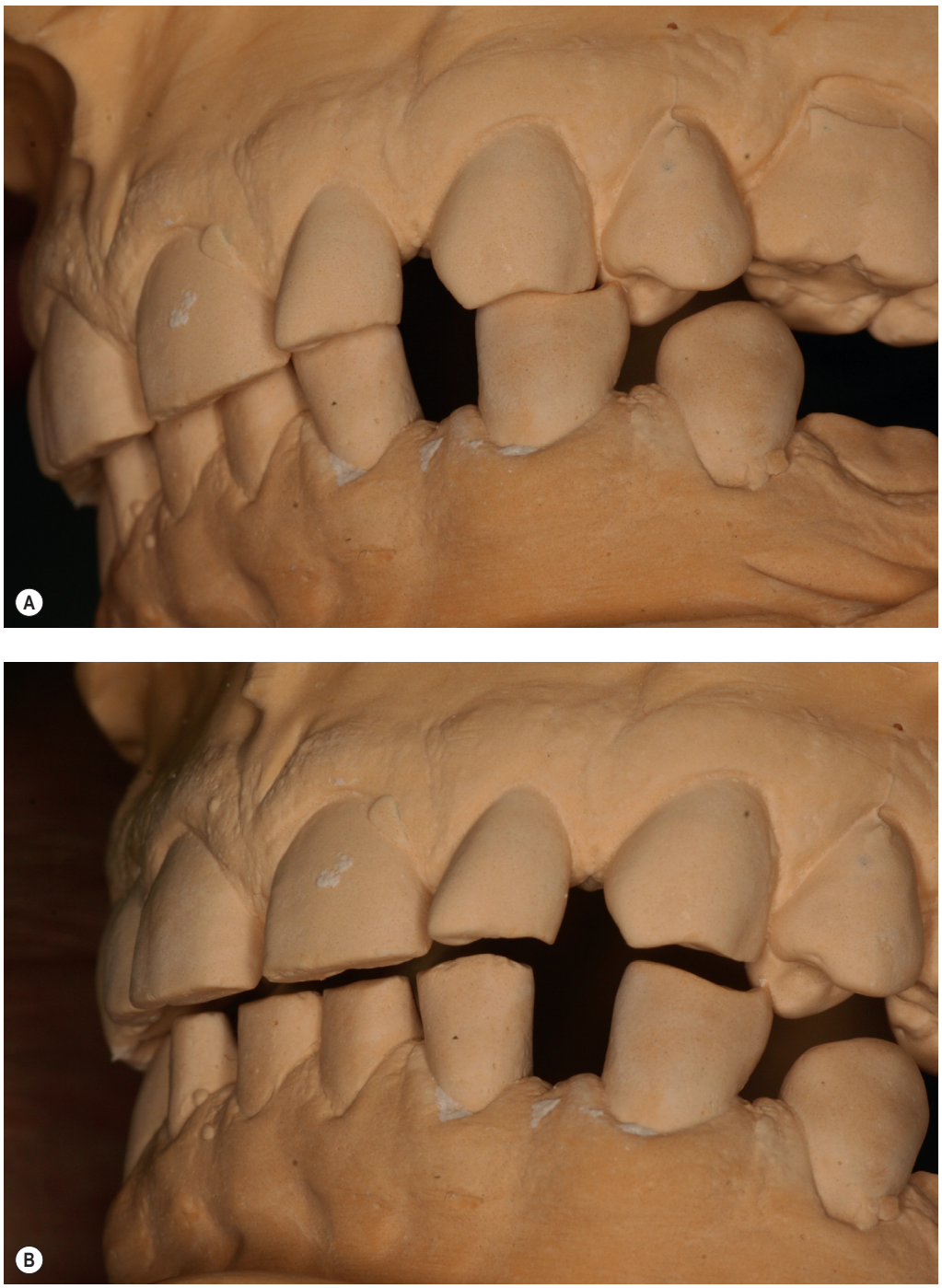

Fig. 3.7 Dynamic occlusal examination. An example of a sizeable inter-occlusal space between the upper and lower teeth when the patient is manipulated from (A) the inter-cuspal position (ICP) to (B) the retruded contact position (RCP). This space may be critical to planning restorative dental care.

should be shared between the anterior teeth to optimize the distribution of occlusal loading.

The nature of the guidance and the occlusal contacts in lateral excursion should also be assessed and noted. Lateral guidance is typically provided by the canine teeth – canine guidance – but may be premolar- or molar-guided, with teeth acting individually or in group function. The morphology of the canine tooth allows it to provide guidance during lateral excursive movements. Indeed, canine guidance is the most common form of lateral guidance in the natural dentition.[26] Canine guidance typically ensures posterior tooth disclusion during lateral excursion.

The presence of any occlusal interference on either the working or the non-working side should be noted, and investigated as indicated clinically.

The use of articulated study casts to analyse the patient's occlusion can be invaluable, if not essential, particularly when a reorganization of the occlusion may be indicated.

The esthetic zone

The esthetic zone, also known as the 'smile zone', includes all the hard and soft tissues that are visible when the patient makes a broad smile. The examination and assessment of the esthetic zone should include evaluation of:

- smile zone shape
- dento-labial relationships
- dental midlines
- tooth colour, texture and form
- tooth size, shape, proportion, symmetry and axial inclination
- contact areas and embrasures
- gingival esthetics.

Smile zone shape

Six smile zone shapes are commonly described in the literature. These are straight, curved, elliptical, bow-shaped, rectangular and inverted. Smile zone analysis should start with determining the smile zone shape.

Dento-labial relationships

There is considerable variation in tooth exposure during smiling, both by and between individuals.

The term 'lip line' or 'smile line' is used to describe the relationship that exists between the inferior border of the upper lip, the maxillary teeth and the gingival soft tissues on smiling, or when a patient is asked to make the sound 'E', commonly referred to as the 'E test'. Tjan et al.[4] have described three types of lip line (Fig. 3.8):

- low smile line – where the maxillary anterior teeth are exposed by no more than 75%, with no display of gingival tissue on smiling
- medium smile line – where 75–100% of the clinical crowns of the maxillary anterior teeth and the associated interdental gingival papillae are exposed on smiling
- high smile line – where all of the clinical crowns of the maxillary anterior teeth and the adjacent gingival tissues, beyond the gingival margins, are exposed on smiling.

Low smile lines are the most forgiving: for example, when there is an exposed cervical margin to a restoration, or an alveolar ridge defect in the anterior region, necessitating the placement of an artificial tooth with an abnormal inciso-gingival dimension and associated asymmetrical gingival profile.

Fig. 3.8 Examples of the different 'smile line' profiles. A. A 'low smile line'. B. A 'medium smile line'. C. A 'high smile line'.

In contrast, high smile lines – the 'gummy smile' – are the least forgiving. High-smile-line smiles can give the impression of relatively small teeth set in excessively large, long gums, or of maxillary teeth positioned too low relative to the upper lip.

Tjan et al.[4] describe the 'average lip-line profile' as the most common smile-line variation. The high-smile-line appearance has been reported to be twice as common amongst females as amongst males,[4] possibly related to the slightly shorter mean length of the philtrum in females. Lip lines may be asymmetric.

Whilst the display of 2–3 mm of healthy gingival tissue, together with the maxillary anterior incisors, is considered to be esthetically acceptable when smiling, the display of 1 mm of gingival tissue has been suggested to conform to the esthetic ideal.[27] In contrast, an excessive display of gingival tissue of more than 3–4 mm is generally considered to be the least acceptable. In such cases the patient may need to be assessed for periodontal 'plastic surgery', orthodontics, the use of botulinum toxin in the levator labii and levator angularis muscles, or, in extreme cases, orthognathic surgery. The aim of any such treatment should be to provide the patient with a pleasing, symmetrical gingival profile on smiling.

The incisal display, when the lips and lower jaw are at rest, may be assessed by asking the patient to say 'M' or 'Emma'. A 'youthful smile' is associated with a greater level of incisal display. After 40 years of age, the incisal edge display at rest decreases by approximately 1 mm every 10 years.[20] The average incisal display for males is slightly less than that for females, in the order of 1.5 mm.[28] This may serve as a useful guideline when attempting to restore worn anterior maxillary segments, or when contemplating smile makeovers to attain a youthful appearance.

The width of the smile should also be assessed. A smile displaying ten maxillary teeth – the incisors, canines and premolars – is the most common smile width pattern.[29] Up to 20% of patients may display their first permanent molar teeth on smiling. Racial variations in smile width are common. The smile width may have a key bearing on the selection of restoration, restorative material and crown margin placement – sub- or supra-gingival – in cases requiring operative intervention.

For optimum esthetics, the dental hard tissues should fill the corners of the mouth to produce a 'full smile'.[30] Where a large negative (black) space exists between the buccal surfaces of the maxillary posterior teeth and the labial commissures – the buccal corridor, smile esthetics may be suboptimal (Fig. 3.9). This may occur when the cross-sectional width of the dental arches is reduced, or

Fig. 3.9 An example of a patient with a prominent 'negative buccal corridor'.

the arches are retropositioned. Under these circumstances, such orthodontic intervention, possibly together with orthognathic surgery, may be indicated.

The smile arc must also be assessed. This term refers to the relationship between the curvature of the lower lip and the curvature of the incisal edges of the maxillary incisor teeth in a posed smile. Ideally, the curvature of the lower lip should follow the curvature of the incisor edges, with the superior border of the lower lip being slightly below the incisal edges. This is commonly termed a 'convex incisal curve'. An example of a smile displaying a convex incisal curve is shown in Figure 3.10. In contrast, a flat smile arc (Fig. 3.11) or a reverse smile arc, often observed with worn dentitions, is generally deemed to be less attractive than a convex incisal curve, and is associated with ageing. An example of a reverse smile arc associated with a worn anterior maxillary dentition is illustrated in Figure 3.12. A reverse smile can have a profound effect on the 'emotion of ageing' and, as such, is considered to be undesirable.[31]

Dental midlines

The dental midline (DM) should, ideally, coincide with the facial midline (FM). The maxillary midline is best assessed against the midpoint of the philtrum. The labial frenum and facial midline are co-incident in approximately 70% of the

Fig. 3.10 An example of a smile displaying a convex incisal curve.

Fig. 3.11 An example of a smile displaying a flat incisal curve.

population.[14] A discrepancy of less than 2 mm between the maxillary midline and facial midline is generally considered to be esthetically acceptable. A variation of more than 4 mm is associated with a suboptimal esthetic appearance, and perfect co-incidence of the DM and FM may result in an artificial appearance. Where there is a discrepancy between the DM and FM that is of concern to the patient, orthodontic treatment may be indicated.

The mandibular midline should ideally be co-incident with the maxillary midline. This, however, occurs in only 25% of the population.[32] A small discrepancy between the two midlines may therefore not have a negative impact on the overall esthetic acceptability of a smile.

Fig. 3.12 An example of a reverse smile arc associated with tooth wear.

Tooth colour, texture and form

Tooth colour

The colour of teeth should be evaluated according to:

- hue – base colour
- chroma – saturation of the base colour
- value – brightness.

There are many shade analysis systems available in the dental marketplace. The base shade should be recorded using a preferred shade guide. Colour variations within and between different teeth in each arch, in particular the maxillary canines, should be assessed and noted. Chroma variations also occur within and between teeth; hence the concept of 'polychromacity', with the incisal third of teeth often displaying low chroma, and a tendency towards translucency, and the gingival third displaying higher chroma than the middle third.

The colour of a tooth may be influenced by many different factors. These include the presence of restorations, loss of vitality, discoloration following trauma and endodontic treatment, caries, areas of hypomineralization and hypocalcification, staining (extrinsic and intrinsic), and cracks and corrosion products from metallic restorations and steroid-based intra-canal materials.

A cross-sectional survey by Kershaw et al.[1] reported that the visible presence of dental caries may be associated with a lower overall rating of physical attractiveness. Clearly, operative interventions to eliminate factors such as caries and leaking, stained restorations will help to enhance the esthetics of a given tooth and, in turn, the dentition.

Interestingly, the above study provided evidence that a whitened tooth appearance may be associated with a higher level of attractiveness than a natural enamel appearance.[1] A youthful dental appearance is generally associated with a dentition that displays a relatively high value and low level of chroma. Ageing is usually associated with a reduction in the thickness of the enamel layer and yellowing of the dentine layer, with narrowing of the lumen of the dentinal tubules and the absorption of stains, resulting in a relatively high level of chroma and low level of value. In addition, ageing is associated with the loss of translucency of the incisal edges, and a reduction, if not loss, of the mamelons.

It is hardly surprising that vital bleaching treatments have become so popular in contemporary dental practice, with an increasing number of patients seeking a more youthful appearance, perceived to be associated with a high level of physical attractiveness.

When assessing patients for possible esthetic dental treatment, it is important to discuss their views on colour variation in the dentition, and to ascertain their perception of dental attractiveness. The patient's skin complexion may also influence colour perception, tooth shade and skin colour having an inverse relationship.

Tooth texture

Tooth surface texture and lustre should also be documented, particularly when planning indirect restorations. A good-quality study cast provides an excellent record of surface texture, amongst other features.

Tooth form

Three common tooth forms have been described in the dental literature. These relate primarily to the form of the maxillary central incisor teeth – the most dominant teeth in the smile. The three forms are:

- ovoid – egg-shaped
- square – quadrangular
- triangular – tapering.

Variations in these forms have been described: for example, square–tapering. Whilst there is little evidence to support the notion, some believe that the form of the maxillary central incisors may reflect the gender, personality and strength index of a patient. Tooth form may change with age, as a consequence of tooth wear.

Tooth size, proportion, shape, symmetry and axial inclination

Consensus opinion suggests that the size, shape and arrangement of the maxillary anterior teeth are the most influential factors in characterizing the anterior dentition.[33]

Tooth size and proportion

A plethora of studies have investigated the average dimensions of maxillary central incisor teeth. The average lengths and widths of these teeth have been reported to be between 10 mm and 11 mm, and 8 mm and 9 mm, respectively.[34] These data indicate that an average maxillary central incisor should have a height-to-width ratio of 1.2 : 1, with the width being approximately 75–80% of the height, as shown in Figure 3.13A. It is also frequently stated that the length of the maxillary central incisor should be approximately one-sixteenth of the height of the face (Fig. 3.13B).

Average values may serve as a useful guide when restoring the anterior dentitions, particularly a worn dentition. However, it is important to remember that average values are subject to certain variations among ethnic and minority groups.

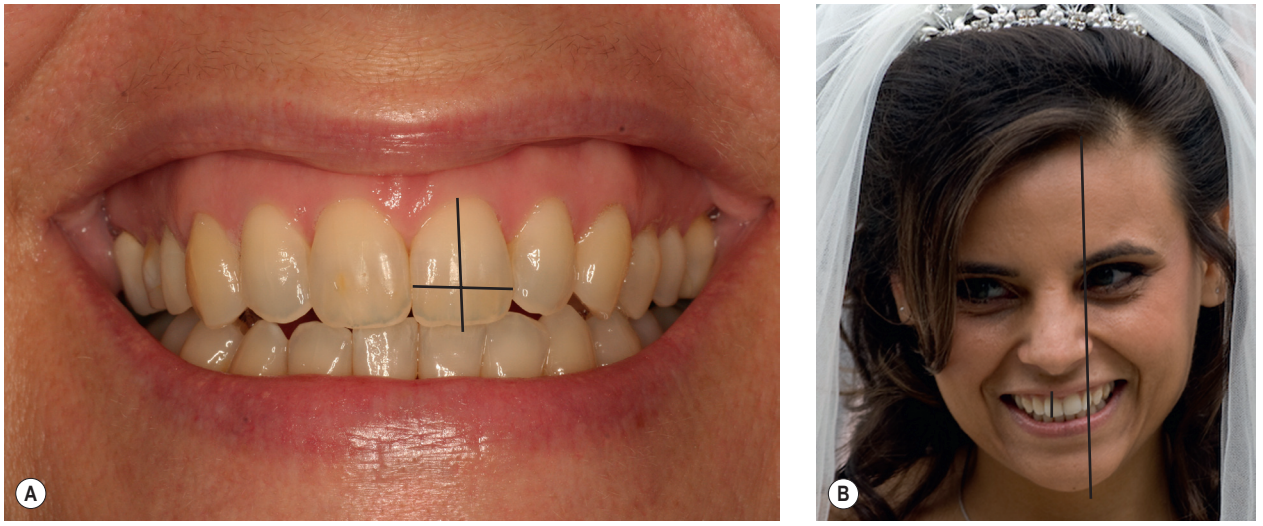

Fig. 3.13 Tooth size and proportion. A. The average maxillary central incisor should have a height-to-width ratio of 1.2 : 1. B. The average maxillary central incisor length should be approximately one-sixteenth of the facial height.

In the case of a patient presenting with an anterior edentulous space, the bizygomatic width and inter-alar width may serve as useful guidelines in determining the most esthetically pleasing width for the maxillary anterior teeth, particularly amongst female patients.[5]

As discussed in Chapter 1, the Golden Proportion is a concept that has been widely applied in esthetic dentistry (see Fig. 3.13A).[35,36] However, the Golden Proportion may only exist in just under one-fifth of all natural dentitions.[37] Accordingly, the concept must be applied with caution when examining and assessing patients for esthetic dental treatment, in particular when the individual has an atypical arch form.[34]

Accordingly, the use of resin mock-up techniques, as described below, or the use of provisional restorations may be the most effective means of determining the most esthetically pleasing tooth dimensions for a patient. Volume 2 of this series covers such mock-up techniques.

Tooth shape

In axial section, the crowns of maxillary central incisor teeth typically display two or three planes in the labial face, as shown in Figure 3.14. The gingival third or half is typically in the same plane as the gingival tissues. The middle and incisal third or, in many cases, half of the labial face has a tendency to curve palatally. This is thought to facilitate phonation and swallowing.[34]

It is important to avoid altering these profiles, as over-contouring in the labial–gingival portion, frequently seen following inappropriate tooth preparation for

Fig. 3.14 The labial face of the maxillary central incisor. When viewed in vertical section, this face is typically formed of two or three planes.

Fig. 3.15 Over-contoured restorations. Over-contoured restorations may compromise dental esthetics, gingival architecture and lip function.

indirect restorations, results in poor esthetics and may contribute to gingival recession, revealing an unsightly restoration margin (Fig. 3.15) In extreme circumstances, over-contouring of the gingival third may result in palatal tipping of teeth and interference with the function of the lip.

Attention should also be paid to the palatal profile of the maxillary incisor teeth. Alterations in this profile may result in a lisp when the patient makes the 'S' sound – a useful phonetic guide when using provisional restorations to verify esthetic and functional satisfaction with planned restorations.

The shape of the incisal edges of the anterior teeth should also be noted. The incisal edge of these teeth should have a tapered, flat form in vertical section. With ageing and physiological wear, incisal edges have a tendency to develop a sharper facio-palatal profile. The iatrogenic creation of a rounded profile often results in poor appearance.

Note should also be taken of the morphology of the central incisors in the frontal plane. Lateral incisors are seldom central and flat when viewed facially; rather, the facial profile should be convex with distinct line angles.

Maxillary lateral incisors often display considerable variations in morphology. Peg-shaped lateral incisors are commonly encountered, and may be present unilaterally or bilaterally. Alternatively, lateral incisors may appear small in comparison to adjacent central incisor and canine teeth.

The morphology and positioning of the maxillary canine tooth have an important role in determining the progression of the patient's smile from the anterior to posterior regions.

The shape of the mandibular anterior teeth should be assessed, with particular attention to the profile and appearance of the incisal edges.

Tooth symmetry

It is widely accepted that a key determinant of the esthetic consideration of a smile is symmetry of the central incisor teeth.[36] However, some asymmetry between the maxillary central incisors is common. It is suggested that differences of more than 0.3–0.4 mm in the dimensions or positioning of these teeth may be readily noticed. The esthetics of asymmetric central incisors may be enhanced if the disto-incisal line angles of the teeth appear symmetrical.

The presence of unilateral peg-shaped lateral incisors, let alone missing teeth, may have a profound effect on the symmetrical arrangement of the anterior maxillary region (Fig. 3.16).

Axial inclination

The maxillary anterior teeth have a tendency to be mesially inclined (see Fig. 3.14). The angle of inclination tends to increase in moving from the central

Fig. 3.16 An example of a patient presenting with a peg-shaped lateral maxillary incisor tooth. This impacts significantly on the esthetic zone.

incisors to the canines. A noticeable lack of symmetry in the axial inclination of the anterior teeth may contribute to poor esthetic appearance. Subtle anomalies in the axial inclination of the lateral incisors may not be displeasing.

Contact areas and embrasures

Embrasure spaces (as in Figure 3.17) should increase in size in moving distally from the midline.[38] When assessing the anterior maxillary dentition, it is important to record details of the embrasure spaces and to consider the ways, if any, in which these spaces may be changed during treatment.

In general, the contact areas between the maxillary central incisors should be in the incisal third. The contacts between the central and lateral incisors should be positioned at the junction of the incisal and middle thirds of the teeth (Fig. 3.18).

Dias et al.[39] have suggested the application of the '50–40–30' rule in defining the esthetic relationship between the anterior maxillary teeth, whereby the ideal contact area between the central incisors is 50% of the length of the clinical crowns; that between the central incisor and lateral incisors 40% of the length of the crown of the central incisor; and 30% of the length of the central incisor tooth between the lateral incisor and canine (Fig. 3.19).

Contacts should be symmetrical.

Fig. 3.17 Black triangles depict 'embrasure spaces' present in the smile zone.

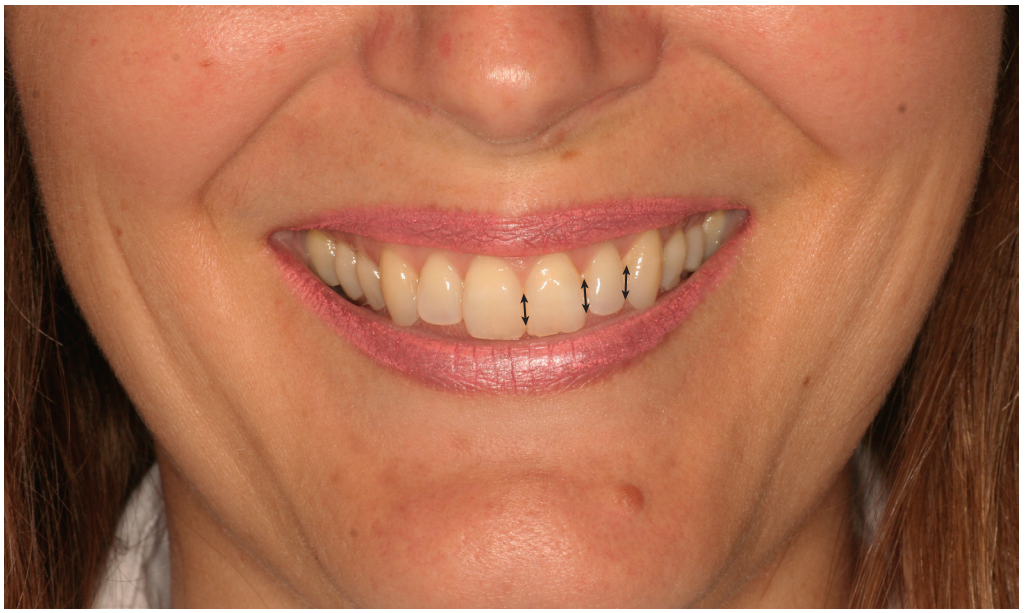

Fig. 3.18 The positioning of the contact areas between the anterior maxillary teeth. The location of the contact area moves apically when moving distally from the midline.

Fig. 3.19 The location of the contact areas in an esthetically pleasing anterior maxillary dentition.

Gingival esthetics

It has been suggested that, for optimum esthetics, the gingival levels of the anterior maxillary segment should be symmetrical, with the gingival margins on the central incisor and canine teeth being slightly (less than 1 mm) higher than on the lateral incisors (Fig. 3.20).[38] Disparities in gingival symmetry are frequently observed in association with localized dento-alveolar compensation, severe crowding, ankylosis, periodontal disease and the substitution of a canine for a maxillary lateral incisor.[38]

The presence of 'black triangles' between the teeth is usually considered to be highly unattractive. Ideally, the space apical to the contact area should be occupied by an interdental papilla of healthy appearance. High smile lines are particularly unforgiving to black triangles. If present in a patient being examined and assessed for esthetic dental treatment, the extent of the triangles should be carefully documented and discussed with the patient.

The morphology of the gingival tissues around each tooth may be found to be very variable. Around maxillary incisors and canines, the gingival outline

Fig. 3.20 Gingival profile associated with an esthetically pleasing anterior maxillary dentition. The black line demonstrates the relative positions of the gingival zeniths of individual teeth in the esthetic zone.

should be elliptical, with the gingival zenith being distal to the long axis of the tooth. Around maxillary lateral and mandibular incisors, the gingival contour should be rounded.[38] It is not uncommon to consider pre-restorative periodontal plastic surgery to enhance the gingival outline.

The gingival biotype – thick or thin – should be noted, as this may influence the ways in which the gingival tissues respond to the placement of dental restorations. In general, thin biotypes are associated with triangular tooth forms, and thick biotypes are commonly associated with square tooth forms.[40]

Edentulous spaces

A number of classification systems have been described for edentulous spaces. The Kennedy classification, which takes account of the location of the saddle(s) (anterior or posterior) and whether they are bounded or unbounded (unilaterally or bilaterally) is widely used.

Edentulous ridges should be assessed for form (rounded, flat, inverted or knife-edged) and for the presence of any hard or soft tissue undercuts. The overlying mucosa should also be examined for thickness and consistency (thick, thin, soft, firm or mobile).

Any existing removable prostheses should be assessed for retention, stability, support, base form, polished surface contours, occlusal function and esthetics.

SPECIAL TESTS

To complete an examination and patient assessment, it is common to have to undertake various special tests. Those typically performed in esthetic dental practice include:

- radiographs – to ascertain, amongst other features, the presence of any existing hard tissue and bony pathology, root morphology, crown : root ratios, the quality of the alveolar bone and any existing endodontic treatments
- cephalometric analysis
- vitality, sensitivity and sensibility tests
- colour photographs
- study casts, typically mounted on an appropriate form of dental articulator
- diagnostic wax and resin mock-ups
- Kesling set-ups.

RESIN MOCK-UPS

The provision of a resin (composite) mock-up is of particular value when planning esthetic and occlusal changes. A resin mock-up allows the clinician and patient to assess planned changes as part of a fully reversible process. A mock-up is also invaluable in transferring a wealth of information to the dental technologist.

The clinical protocol involves drying the anterior teeth, followed by the placement of resin composite of an appropriate shade, without any conditioning or bonding of the tooth tissues. In this way, resin composite can be added, subtracted and contoured to assess changes in the following features:

- tooth size, shape, axial inclination
- co-incidence of the dental and facial midlines
- parallelism between the anterior occlusal plane and the inter-pupillary or commissural lines
- contact areas, embrasure form and connector morphology
- dental proportions and symmetry
- buccal corridor.

Dento-labial relationships can also be assessed, together with phonetic tests, by asking the patient to enunciate the 'E', 'F', 'V' and 'S' sounds.

CLINICAL TIP

Have a laminated sheet of prose for the patient to read out loud.

The effect of any changes to the shape of the anterior teeth on the anterior guidance may also be assessed, as may any proposed change in the occlusal guidance.

The reversibility of resin mock-ups also enables the clinician to determine whether the needs and expectations of the patient, and possibly the patient's partner and family, are realistic and attainable. Treatment planning should be delayed until all parties are satisfied with the mock-up.

Once a mock-up has been accepted and is considered feasible, an over-impression should be taken and dispatched to the dental laboratory, together with

Fig. 3.21 Using mock-ups. A. Preoperative view of a patient with esthetic concerns in relation to the anterior maxillary dentition. B. Completed intraoral mock-up as part of the information provided to the dental technician.

photographs of the mock-up in situ. This information allows the dental technologist to create wax mock-ups and to refine the planned esthetic and functional changes at the appropriate stages in the treatment (Fig. 3.21).

The 'Snap-On Smile' is a recent innovation by DenMat (USA) that enables the reversible evaluation of the acceptance of esthetic alterations. It is a custom-made removable appliance similar to an orthodontic retainer, which engages undercuts present in the gingival third of the teeth. Whilst bulk, lack of stability and bad taste are commonly reported with the use of this type of appliance, it can serve as a useful diagnostic tool and an interim solution to an esthetic problem.

CONCLUDING REMARKS

Meticulous patient assessment and examination are pivotal to achieving successful outcomes in esthetic dental practice. The clinician must have a clear understanding of the concepts of symmetry, proportion, shape, function and form that underpin treatments aimed at achieving an esthetically pleasing dento-facial appearance. The clinician must, however, refrain from stereotyping and judging patients relative to 'ideals'. Each and every patient must be attentively listened to and assessed as an individual, according to their concerns, needs and expectations.

The use of reversible mock-up techniques can help to establish whether it is possible to meet the patient's needs, as well as serving as a most useful means of conveying essential information to the dental technologist.

In examining and assessing a patient for possible esthetic dental treatment, clinicians must draw on all their understanding, knowledge and clinical experience in the interests of best serving the patient. If, at the conclusion of the examination and assessment, the clinician has uncertainties, the best interests of the patient may require referral for further investigation.

CLINICAL TIP

The first treatment option should be no treatment, particularly when considering options for managing esthetics, which is not, after all, a disease!

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