

An analysis of the components of a human smile

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The Ideal Smile

Whilst the old saying 'beauty is in the eye of the beholder' may be true, patients are increasingly becoming aware that a powerful smile is a true asset. But what makes the 'ideal smile'?

Once I revert to my younger self starting dental school, I could probably reel off an answer along the lines of 'well aligned, white and clean teeth'. However, a definition such as this lacks depth and insight. Now that I have been through four years of clinical training and performed procedures such as composite restorations, denture fabrication and crown/bridge work in the anterior dental aesthetic zone, I have gained an in depth appreciation of how several factors must be considered during appraisal of anterior dental aesthetics.

This essay aims to describe the key factors, which must be considered and assessed when creating the 'ideal' smile, such as facial, gingival and dental aesthetics. It must be remembered that there is difficulty in defining an 'ideal' smile as there is significant variation between individuals and populations.

As patients have increasing aesthetic demands, it is imperative that we are understanding their needs, communicating effectively and delivering on their needs and desires. Every patient that we treat has a unique set of characteristics, desires and priorities and the superimposition of a standard, pre-designed 'ideal' smile will not be acceptable. In this regard, it is right of dental professionals to address dentistry as art as well as science. We should endeavor to provide a beautiful smile, which matches the patient's facial form, gingival architecture and personality. The fundamental principle of smile design is that the approach employed respects the relation between hard and soft tissue. I will progress by dividing this essay into individual components for discussion. However, the end result of any smile transformation/appreciation will require the blending of all componentry, rather than analysis of the various factors in isolation [1].

Lip Architecture

The lips frame the smile and are a site that muscles act upon. It is therefore important to consider them in static and dynamic phases. The static position is when the lips are slightly held apart at rest with perioral muscular activity not employed [2]. On average around 2-4mm of the upper incisors are displayed at rest, but the amount of incisal show is governed by the lip form (strap like or thicker forms), patient age, sex or race [3].

The age of the patient can impact the degree of gingival exposure as aging results in loss of tonicity and elasticity of facial muscles and collagen fibres. This process results in a reduced amount of maxillary tooth show and an increase in the amount of mandibular tooth display [4]. The extent of tooth display during function is characterised by the

patient's skeletal pattern, positioning of the teeth and length/size of the upper and lower lips [5].

The position of the smile line will affect the characterisation of the smile. On average, a low smile line only allows for around 30% of upper central incisal show. A higher smile line/'gummy smile' will allow for up to 2 mm of gingival show in addition to the upper first incisor [2].

Soft Tissues

Of critical importance is the degree to which the teeth and soft tissues adapt with each other. Well-pronounced interdental papilla should be present avoiding the appearance of black triangles/interdental recession. The gingival margin should coincide with the enamel-dentine junction on the teeth, only allowing for the anatomical crown of the teeth to be displayed; root surfaces should not be exposed [2]. The dental midline should coincide with the facial midline and the smile should be symmetrical, so as the same teeth are exposed on either side of the midline and their relative positions on the dental arch are identical. In reality, only around 70% of the population have coincident facial and dental midlines. In order to achieve optimal smile aesthetics, the commissural line (between the corners of the mouth during smiling), occlusal plane and interpupillary line should all coincide [6].

The smile arc, that is the semi-circle demonstrated when the upper incisal edges come into close proximity with the lower lip border in the posed smile, is an important factor in smile aesthetics. It should not be over or under pronounced. Through the aging process, the incisal edges of the maxillary anterior teeth often get flattened and less well defined through tooth wear or modified tooth eruption results [7].

From an orthodontic viewpoint, the alignment of the maxillary teeth is more important than that of the mandibular dentition. The midlines of maxillary and mandibular arches fail to align in around 75% of the US population. The buccal corridor, space between the lining of the vestibule and the buccal surfaces of posterior teeth, should be evident so that the teeth are separated from the corners of the mouth [8].

The gingival architecture forms the soft tissue framework around each individual tooth. The gingiva should be coral pink in colour and provide firm texture. The attached gingiva can be either smooth or stippled in appearance. The gingival tissues play a significant factor in the appearance and aesthetic value of the smile, especially in high lip line patients where gingival tissues are exposed to an ever-greater degree. In the healthy periodontium, the spaces under the contact areas are filled with healthy interdental papilla, which ensures there are no black triangles that will compromise the aesthetic power of the smile.

Tooth Shape and Colour

Tooth morphology is a fusion of square, oval and triangular shapes, where square teeth have straight and parallel mesial and distal borders, oval teeth have curved mesial and distal borders and triangular teeth have marked line angles and significant degrees of convergence from incisal to cervical regions [9]. Frush and Fisher's [10] theory of morphopsychology placed aesthetic smile design on a rational footing by suggesting that the shape and form of teeth are linked with a patient's age, sex and personality. They described that young patients will have sharp incisal edges and their upper central incisors will have more prominence, whereas older patients will have worn-out and bluntly defined incisal edges. For female patients, a curved and rounded tooth form would be more appropriate; in the same manner as clearly defined, sharp, angled tooth forms would suit the male patient. It is important to understand the nature and personality of the individual patient when restoring tooth form [11].

Patients are beginning to appreciate the importance of tooth colour when committing to dental treatment plans. The physical characteristics of light should be considered when restoring/mimicking actual tooth structure: factors such as opacity, translucence, reflectance and fluorescence should all be assessed.

The colour of an individual tooth can be split into three critical components. Value is defined as the luminosity of the colour/degree of greyness and is considered to be the most clinically important element of shade result. The second most important factor is considered to be chroma: the saturation/dominance of the colour (hue). Hue is defined as the wavelength of coloured light transmitted as the actual colour of the tooth and is considered least important due to the relative low concentrations of hue in actual tooth shade [12]. The shades of maxillary anterior teeth pass through a slight progression from cervical margin to incisal edge, as well as from one tooth to the next. Upper central incisors are known to be the brightest and lightest individual teeth, which also help them to dominate the smile [13]. The upper lateral incisors have relatively close hue values to that of the centrals, but differ in that they have lower value properties. Canines hold the greatest degree of chroma and have the lowest value properties. The premolars hold value properties similar to the lateral incisors but will appear lighter than the canines [14]. When assessing an individual tooth, the middle third portion of the tooth is generally the brightest, followed closely by the cervical third portion of the tooth. The incisal third will hold the least value characteristic due to their higher degree of absorption of light and higher degree of transparency [15].

Tooth Size, Dimension and Inclination

It is of vital importance to ensure that the teeth are symmetrical and provide a sense of balance and proportion. The dominance degree of individual teeth should reduce from the midline moving distally, with upper central maxillary incisors always having the greatest dominance. Although it may be tempting to try to think of a 'magic number' for tooth dimensions, in order for the resultant smile to be a success, individual variation should be introduced to create a more natural effect. These variations should be subtle and should only be introduced if they are acceptable to the patient. Sterrett et al. [16] described a method of determining the average size and proportions of any given tooth in a smile. The average male tooth is greater in size than that of the female tooth and gender has very little effect on the crown height: width ratios and therefore the final dimensions of the tooth. Sterrett et al. [16] also published that the average maxillary central incisor should

have a width: length ratio of 0.8, any lower and a tall, narrow tooth would result, any greater and the result would be a short, stubby tooth. The central incisor should ideally be around 2 mm wider than the lateral incisor, which should ideally be 8 mm (length) and 6.3 mm (width). Average values of the canine tooth are: 9.5 mm (length) and 7.4 mm (width). It should be noted that the maxillary central incisors and canines ideally would have similar heights of their clinical crowns.

The dental literature refers to the 'golden proportion' principle, which determines the desired widths of the teeth in the anterior aesthetic zone. A ratio of 1 is given to the maxillary lateral incisor, a value of 1.6 to the maxillary central incisors and a value of 0.62 to the maxillary canines [17]. The golden proportion is a principle usually used for construction, automobiles and objects, but it has some value in dentistry. Strict adherence should not be encouraged, as some degree of individual variation is acceptable and more natural looking. It can, however, be employed as a guidance measure and methodology when designing a smile.

The long axis of the upper central incisor should be aligned with the dental midline. The upper lateral incisor should be slightly mesially tipped towards the midline and the upper canine should be tipped mesially to an even greater degree, allowing for the achievement of an aesthetically pleasing smile [2].

The connector rule of 50-40-30 applies in the areas where two teeth appear to be contacting. The connector space between the upper centrals should be 50% the length of the upper central crown. In the same manner, the connector space mesial to the upper lateral should be 40% of the length of upper lateral crown and mesial to the canine should be a 30% connector space [18]. The incisal embrasures should increase in size and volume from midline distally, to give the impression of sharp and clearly defined teeth [19-21].

Conclusion

Every tooth has its own anatomy and attention should be paid to the surface texture, colour, tooth form and alignment in the arch. Heavy surface textures will create multiple zones of reflection and deflection, creating a youthful appearance.

Society pays more attention to looking and feeling youthful and patients are starting to desire bright and white smiles. The dental profession is entrusted with the task of creating beautiful smiles and whilst the technology/techniques are being continuously developed and adapted, the basic principles of what constitutes the 'ideal' smile, will likely remain the same. The individual components that have been discussed need to be integrated together in a holistic approach to evaluate a smile, accounting for the micro and macro aesthetic componentry. However, above all, the 'ideal' smile in all cases can only be defined as one which has matched and exceeded both patient and clinician expectations and desires and an 'ideal' smile may somewhat vary from individual to individual and from population to population.

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