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# Facial Aesthetics: 1. Concepts and Canons

**Abstract:** The clinical ability to alter dentofacial form requires an understanding of facial aesthetics. This is vital for any clinician involved in treatment that will alter a patient's dentofacial appearance, whether through orthodontics, facial growth modification, corrective jaw surgery or aesthetic dentistry. Part 1 of this article aims to cover the historical and theoretical aspects of facial aesthetics and their importance in contemporary dentofacial treatment. Part 2 will cover important aspects of the interview and clinical assessment of patients requiring alterations in their dentofacial appearance, including guidelines used in the assessment of facial proportions and symmetry.

**Clinical Relevance:** These articles cover the theoretical and clinical aspects of facial aesthetics required by clinicians involved in the treatment of dentofacial deformity.

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Beauty has been defined as a combination of qualities that give pleasure to the senses or to the mind. It is a philosophical concept, the aspects of which are studied under the term aesthetics, derived from the Greek word for perception (aisthesis). Aesthetics, therefore, is the study of beauty and, to a lesser extent, its opposite, the ugly. It involves both the understanding and evaluation of beauty, proportions and symmetry.<sup>1</sup>

The assessment of facial beauty is immersed in subjectivity and therefore leans towards the world of art. Facial proportions and facial balance, however, can be measured and therefore fit somewhere between art and science. Aesthetics itself is now essentially a science in the formation, although obviously with a very strong philosophical and artistic background.

Part 1 of this article aims to cover the historical and theoretical aspects of facial aesthetics and their importance in contemporary dentofacial treatment.

## Historical background

### Facial beauty

In western literature beauty has been described as everything from a 'social necessity' to a 'gift from God', with facial beauty being perhaps the most valued aspect of human beauty. The poet John Milton refers to the 'strange power' of beauty, describing beauty as 'Nature's brag'.

The question, 'What is beauty?' has been, and continues to be, one of the most debated and written about concepts in western literature.<sup>1</sup> Beauty may be considered a mystifying quality that some faces have, or may be, 'in the eye of the beholder' as the writer Margaret Wolfe Hungerford (1878) stated. Plato (428–348 BC) alluded to this concept in his *Symposium*, where he described 'Beholding beauty with the eye of the mind'. Shakespeare re-iterated this view in *Love's Labour's Lost*, saying, 'Beauty is bought by judgement of the eye'. The philosopher Immanuel Kant (1790), in a treatise entitled

*Critique of Judgement* stated 'The beautiful is that which pleases universally without a concept'. Therefore, perhaps beauty as a concept can be perceived but not fully explained. This debate will no doubt continue.

### What constitutes the human perception of facial beauty?

The human perception of facial beauty may have genetic, environmental or multifactorial foundations. Evidence to support a genetic theory is that infants, from newborns until two years of age, when simultaneously presented with two facial photographs, have a tendency to stare longer at the face previously rated as more attractive by adults.<sup>2</sup> The evolutionary basis is that facial beauty is a requirement for sexual selection, leading to improved opportunity for reproduction.<sup>3</sup> A considerable quantitative meta-analysis undertaken by Langlois *et al*<sup>4</sup> seems to confirm that there is also cross-cultural agreement regarding facial beauty.

Studies in the late 1800s by Sir Francis Galton, the cousin of Charles Darwin, accidentally found evidence to support what came to be known as the 'averageness hypothesis' of facial beauty,

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**Figure 1.** Queen Nefertiti. The famous face is well proportioned and symmetrical. (Berlin Museum).

with composite facial photographs gaining higher attractiveness ratings than their individual facial photographs.<sup>5</sup> However, Perrett *et al*<sup>6</sup> have shown that attractive composite faces were made more attractive by exaggerating the shape differences from the sample mean. Therefore, an average face shape is attractive but may not be optimally attractive.<sup>7</sup>

Facial symmetry also seems to be an important aspect of facial beauty, although mild asymmetry is essentially normal.<sup>8</sup>

Therefore, our perception of what constitutes facial beauty seems to be multifactorial.

#### Facial proportions and symmetry

The concept that 'ideal' proportions are the secret of beauty is perhaps the oldest idea regarding the nature of beauty.<sup>9</sup> The ancient Egyptians had a great interest in art and beauty. The famous painted limestone figure of Queen Nefertiti (c 1350 BC) (Figure 1),

with her harmonious facial proportions and symmetry, is an example of how the Egyptians immortalized the beauty of their kings and queens by depicting them, perhaps unrealistically, with 'ideal' facial proportions. In fact, the name Nefertiti literally means the 'Perfect One'. Lesser dignitaries were not so honoured and had more realistic depictions in art and sculpture. The Egyptian proportional canons, however, used grids with meshes of equal-sized squares. This was to change with the age of Greek sculpture which, rather than featuring fixed units, described proportion between the parts of the whole human figure.

In the course of his travels, the Greek mathematician Pythagoras (6th century BC) is extremely likely to have come into contact with the mathematical treatise of the Egyptians. He postulated that beauty could be explained through mathematical laws and laws of proportion. He proposed an explanation of beauty through a significant finding that plucking taut strings of proportionately different lengths produces harmonious notes. The difference in the proportionate lengths of the strings followed mathematical laws, and hence his explanation of laws of proportion. The term Pythagoras used to describe beauty was 'cosmos' as he felt that beauty was part of the mathematical order of the universe, hence the origin of the word 'cosmetic'.

Throughout the ages, painters and sculptors have attempted to establish ideal proportions for the human form, however, possibly the most famous of all axioms about ideal proportions is that of the Golden Proportion.<sup>10</sup>

#### Golden Proportion

This is a geometrical proportion in which a line AB is divided at a point C in such a way that  $AB/AC = AC/CB$ . That is, the ratio of the shorter section to the longer section of the line is equal to the ratio of the longer section to the whole line. This gives  $AC/AB$  the value 0.618, termed the Golden Number. The point at which the line is divided is known as the Golden Section and is represented by the symbol  $\Phi$  (Phi), derived from the name of the Greek sculptor Phidias. This proportion has classically been described as pleasing

to the eye, the emphasis being upon the proportion of the parts to the whole. The prominent mathematician Euclid (c. 325–265 BC) described this in his treatise *The Elements*. In his edition of *Euclid's Elements*, the mathematician Luca Pacioli (1509) re-named the Golden Proportion the 'Divine Proportion' as he felt the concept could not be fully explained, and published a treatise entitled *De Divina Proportione (On Divine Proportion)* for which Leonardo da Vinci drew figures of symmetrical and proportionate faces and bodies.<sup>1</sup> Maestlin gave the first known calculation of the Golden Proportion as a decimal in a letter to his former pupil, the famous astronomer Johannes Kepler, in 1597.<sup>11</sup>

Another often quoted concept, which gives some credence to the Golden Proportion, is the Fibonacci sequence.<sup>10</sup> The distinguished mathematician Leonardo of Pisa (1170–1240), also known as Leonardo Fibonacci, devised a number sequence in which each number is the sum of the two preceding numbers, ie 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 etc. In the 19th century, the mathematician Edouard Lucas coined the term Fibonacci sequence, and scientists began to discover the numbers in nature, such as in the spirals of sunflower heads, the logarithmic spiral in snail shells and in animal horns. As the numbers increase in magnitude, the ratio between succeeding numbers approaches the Golden Proportion.

Attempts have been made to apply the concept of the Golden Proportion to dental aesthetics. In terms of smile aesthetics the Golden Proportion may be applied to the apparent mesiodistal width of the anterior teeth when viewed from the frontal aspect. This can be useful in designing the relative width of teeth in a beautiful smile.<sup>12</sup>

There have also been attempts to correlate ideal facial proportions with the Golden Proportion.<sup>10</sup> However, the faces of professional models have not been found always to fit the Golden Proportion,<sup>13</sup> and a study looking at the aesthetic improvement of patients undergoing orthognathic surgery found that, while most subjects were considered more aesthetic after treatment than before, the proportions were equally likely to move away from, or toward, the Golden Proportion.<sup>14</sup> Therefore, more evidence



**Figure 2.** Doryphorus ('Spear Bearer'). In the 5th century BC Polycleitos wrote the *Canon* in which he laid down the guidelines for the ideal proportions of the human body, possibly founding them on precise numerical relationships described by Pythagoras. In this statue, also often referred to as the 'Canon', Polycleitos created the archetype of the Greek ideal of male beauty. (Naples Museum).

is required to substantiate the true significance of this fascinating concept in the clinical assessment of facial aesthetics.

**Canons of Proportion**

The idealization of human proportions was a major preoccupation of Greek sculptors. One of the most famous, Polycleitus (late 5th century BC), wrote the *Canon*, a theoretical work that discussed ideal mathematical proportions for the parts of the human body. The mathematical proportions and laws described by



**Figure 3.** Aphrodite of Melos (known in French as 'Venus de Milo') is a representation of the classic Greek facial profile. The facial profile is orthognathic (orthos = correct; gnathos = jaw). The sweep from the forehead to the nasal tip is also almost straight. The vermilion border of the upper lip has a classic curve, which later served as the model for the Roman bow of love, termed 'Cupid's bow'. (Louvre, Paris).

Polycleitus were possibly based on those initially described by Pythagoras, originally based on harmonious musical intervals, as previously discussed. Roman copies of one of his most famous statues, the 'Doryphorus' ('Spear Bearer'), still exist. This statue is itself often referred to as the 'Canon' because it embodies Polycleitus' views on the correct proportions of the ideal male form (Figure 2). In the 2nd century AD, the prominent Greek physician and philosopher Galen said, 'Beauty does not lie in the individual parts, but in the harmonious proportion of all the parts to all the others, as is stated in the Canon of Polycleitus.'

Phidias (c 490–430 BC), a contemporary of Polycleitus, was an Athenian famous as one of the most outstanding of all sculptors. He directed the construction and design of the Parthenon, the chief temple of the Greek goddess Athena on the hill of the Acropolis at Athens. The Parthenon itself, and the statues contained within it, were said to conform to 'ideal' proportions, with Phidias incorporating the Golden Proportion into the architectural design.<sup>15</sup> It is said of Phidias that he alone had seen the exact image of the gods, and that he revealed



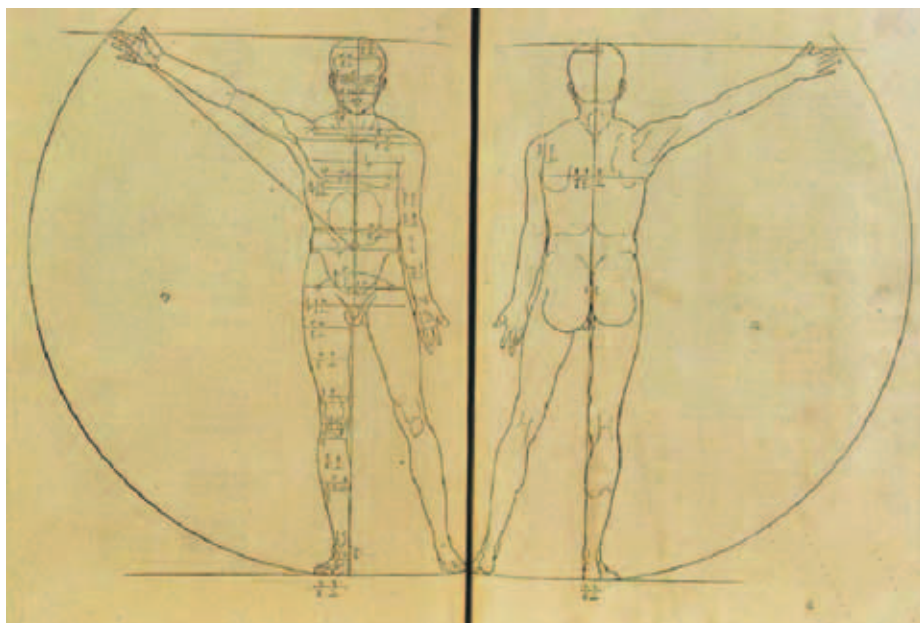
**Figure 4.** Leonardo da Vinci's *Male head in profile with proportions*, ca. 1490. (Gallerie dell'Accademia, Venice).



**Figure 5.** Leonardo da Vinci's *Vitruvian man*, ca. 1490. This famous figure shows that the proportionate human form fits perfectly in perfect geometric shapes, the circle and the square. The navel forms the centre. It is based on the 'ideal' male proportions described by the Roman architect Vitruvius. (Gallerie dell'Accademia, Venice).

it to man. In ancient Greece, sculpture of the human form was used to represent the many gods. As these sculptures were constructed with ideal proportions, the





**Figure 6.** Albrecht Durer's representation of proportions and symmetry in the human form. (From *Treatise on Human Proportions*).

belief arose that the better 'mortals' looked, the more god-like they were (Figure 3).

Polycleitus also described the importance of the concept of symmetry in the human form combined with ideal proportions, which he referred to as 'symmetria'. The Roman architect Marcus Vitruvius Pollio (1st century BC) is well known for describing the facial trisection. He referred to the 'symmetrical harmony' of the 'ideal' human body and compared this to 'perfect buildings'.<sup>16</sup> Vitruvian concepts of proportion and symmetry were essentially Hellenistic, being based on those of the Greeks. Vitruvius' influence continued through his ten-volume work *De architectura*. Leonardo da Vinci later immortalized aspects of Vitruvian concepts, regarding the proportions and symmetry of the human body.

Leonardo da Vinci (1452–1519), the Renaissance genius who excelled as a painter and sculptor, in addition to architecture, engineering, human physiology and anatomy, defined proportion as the ratio between the respective parts and the whole.<sup>17</sup> His notebooks reveal his quest for the ideal facial proportions. He produced studies of the proportions of the human head (Figure 4), a table of possible nose types, and combinations of various forms of foreheads,

chins, noses and mouths. The figure of Vitruvian man (Figure 5), which Leonardo based on guidelines described by Vitruvius, represents 'ideal' male proportions based on man's navel as the centre of a circle enclosing man with outstretched arms. This shows the importance of proportions in the human form. The distance from the hairline to the inferior aspect of the chin (soft tissue menton) is one-tenth of a man's height. The distance from the top of the head to soft tissue menton is one-eighth of a man's height. The clinical implication is that, when planning treatment changes, for example to the vertical face height of a patient, it can be misleading to base the intended result on absolute numeric values based on population norms. People are not necessarily 'average'. It is prudent, therefore, to plan treatment bearing in mind the patient's standing height and stature, and aim to correct the individual's proportions.

Albrecht Durer (1471–1528), generally acknowledged as the greatest German Renaissance artist, maintained the importance of studying facial proportions.<sup>18</sup> His *Treatise on Human Proportions*, published posthumously in 1528, contained illustrations depicting perfect proportions of the aesthetically 'ideal' human face and figure (Figure 6). Durer maintained that disproportionate human faces were

unaesthetic, whereas proportionate features were acceptable if not always beautiful.<sup>19</sup> Therefore, clinicians can make the assessment of facial aesthetics more objective by diagnosing and helping to correct facial disproportions.

Therefore, the guidelines used by clinicians today are based on those initially described in art and sculpture, albeit somewhat modified from the original.<sup>1</sup> What clinicians would today refer to as evidence for what constitutes 'ideal' facial measurements, based on population averages, comes from growth studies using cephalometric radiography<sup>20</sup> and anthropometry.<sup>21</sup> However, these have their own limitations.<sup>22</sup>

## The importance of facial aesthetics

### Self image and negative self-perception

A person's own perception of their facial appearance and any associated deformity is of great importance.<sup>23</sup> Of course, there is considerable individual variation in people's abilities to adapt to their facial deformity, whatever the severity. Some individuals remain comparatively unaffected, while others may have significant difficulties, which affect their quality of life.

### Outsider's perceptions

#### Social disability

It has been argued that facial deformity may be a 'social disability', as its impact is not only on the individual affected, but is noticed by and reacted to by others.<sup>24</sup> Attractive children tend to be perceived more positively by their parents,<sup>25</sup> by teachers who perceive more attractive children as being more intelligent<sup>26</sup> and, in professional life, where less attractive adults are perceived as having fewer qualifications and less potential for employment success.<sup>27</sup> Although an individual's facial appearance contributes to the opinions other people form of them, obviously these opinions may well change as interpersonal relationships form. Nevertheless, an individual's first impression on others may well affect their own self-esteem and quality of life.<sup>24</sup>

#### Stereotyping

It is suggested that people tend

to stereotype others based on their facial appearance.<sup>4</sup> For example, individuals with significant Class II malocclusions and mandibular retrognathia/retrogenia may be seen as weak and possibly idle, whereas individuals with significant Class III malocclusions and mandibular prognathism may be seen as aggressive personality types.

### Teasing

Children in the school environment can be unsympathetic and hostile to those with visible differences, with teasing and bullying being everyday occurrences. The frequency of teasing directed at those with dentofacial differences is significant.<sup>28</sup>

### Severity of deformity

The psychological distress caused by a facial deformity is not proportional to its severity. Research seems to indicate that facial deformities of a mild to moderate nature actually cause patients greater psychological distress than severe facial deformities.<sup>29</sup> This is thought to be because other people's reactions towards milder deformities are more unpredictable, whereas more severe deformities tend to evoke more consistent reactions, albeit negative, allowing the patient to develop better coping strategies. The variability in people's reactions to milder facial deformities also results in considerable patient distress. It is important to note that the majority of patients seeking orthodontic treatment or orthognathic surgery fit into the mild/moderate category in terms of facial deformity, as opposed to craniofacial malformation syndromes or severe facial trauma/disease.<sup>1</sup>

In Part 1 of this article we have covered the historical and theoretical background to our current understanding of facial aesthetics within contemporary dentofacial treatment. Part 2 will aim to cover important aspects of the interview and clinical assessment of a patient requiring alterations to his/her dentofacial appearance, including guidelines used in the assessment of facial proportions and symmetry.

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