

The golden proportion - God's building block for the world

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The golden proportion has been known since a long time and is considered a proportion often cited as occurring frequently in nature. It has been described by many artists, mathematicians, scientists and philosophers. The proportion encompasses both living and nonliving entities; even artificial components and structures appear to be directed to conform to the golden proportion. It appears that humans are genetically programmed to recognize this proportion as pleasing since it explains beauty and is related to the science of numbers. The ideal proportion is related directly to the golden proportion that ranges from 1 to 1.618. The golden proportion is considered a universal standard for facial beauty, and its use may help simplify the diagnosis of facial and dental disharmonies, and treatment using this standard will help restore optimal facial esthetics.

Key words: Fibonacci series, golden proportion, golden rectangle

INTRODUCTION

If we study the beauty of nature, art or teeth, we will discover a common principle running throughout. We can easily agree that an object of art has a good or bad proportion or that a face appears too long or small and out of proportion. This magical proportion, known since antiquity, is none other than the golden proportion, a phenomenon associated with beauty.

This article attempts to illustrate a few facets of the mystical golden proportion. It is one of the building blocks of beauty that we can easily apply to our profession of dentistry with assured success.

THE CONCEPT OF GOLDEN PROPORTION

Whilst the concept of the golden proportion is easy to understand, attempts at its application have proved to be complex and difficult to explain. Its very simplicity is perplexing. To clarify the golden proportion concept, a number of line pairs of different lengths and their ratio to each other are shown [Figure 1]. The last line shows the ratio of 1 to 0.618 (or 1.618 to 1), which is the simplest form of the universally acclaimed golden proportion.

THE FIBONACCI SERIES

No consideration of the golden proportion can be complete without the mention of the Fibonacci Series (after Leonardo Fibonacci), which is a complementary view of the golden proportion. In this number series,

each term is the sum of the previous two terms as follows:

0 1 1 2 3 5 8 13 21 34 55 89... and so on.

The division of any two adjacent numbers yields the extraordinary golden proportion (also known as the golden section, divine proportion or the phi (ϕ) value) e.g., $34/55 = 0.618$ or inversely $55/34 = 1.618$.

The Fibonacci numbers are a natural system of numbering and are applicable to the growth of all living things, including a single cell, a grain of wheat and even all human beings.

THE GOLDEN PROPORTION CALIPERS

The golden proportion calipers were developed for rapid and easy examination of the validity of the impressive golden proportion. These calipers always open to a constant golden proportion between the

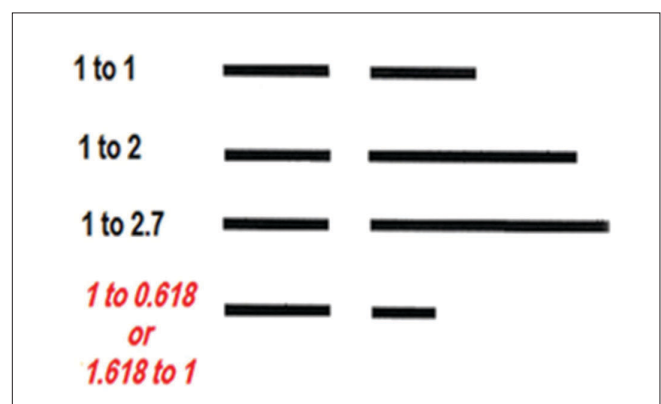


Figure 1: The golden proportion concept

larger and smaller portions. A simple example of the golden proportion in nature using the calipers has been demonstrated [Figure 2].

GOLDEN PROPORTION AND FACIAL BEAUTY

Jefferson Y^[1] proposed the following concepts establishing the existence of a universal standard for the facial beauty based on the golden proportion:

1. There is a universal standard for facial beauty regardless of race, age, gender and other variables.
2. The universal standard is based on a divine proportion, and the divine proportion is universal and synonymous with beauty.
3. All living organisms, including humans, are genetically encoded to develop and conform to the divine proportion.
4. Facial and body disproportions/abnormalities occur due more to environmental factors than to genetic factors.
5. The following biological equation holds true for all humans regardless of race, age, gender and other variables:

Golden proportion = facial beauty = temporomandibular joint (TMJ) health = psychological health = physiological harmony = fertility = total health and wellness = quality of life.

FACIAL PROPORTIONS AND HUMAN HEALTH

Ideal facial proportions are universal and based on the golden proportion, i.e., the width of the face is a golden section of the length of the face beginning from the top of the head till the bottom of the chin. A deviation from this ideal proportion can result in health problems. For instance, patients with long face syndrome have a greater tendency toward an incidence of obstruction of the upper respiratory tract and mouth breathing. Patients with short face syndrome have a greater tendency of incidence of craniofacial pain and headaches due to migraine.^[1]

REVIEW OF THE GOLDEN PROPORTION IN DENTAL LITERATURE

The application of the golden proportion to dental esthetics was first documented by Lewin EI^[2] in 1978 who also explained its history and mathematics. He also explained regarding the association of the proportion with an esthetically pleasing dentition and smile.

Mack MR^[3] discussed the importance of treating the dentition according to the face based on the divine proportion. He stated that the lower one-thirds of the face significantly influences the facial appearance and warned regarding potential complications occurring

in facial esthetics when only mounted casts were used for diagnosis.

Jefferson Y^[4] illustrated many golden proportion diagrams and computer generated photographs providing an ideal picture of the complete head. His work was also supported with cephalometric tracings.

Contrary to the golden proportion concept, Lombardi RE^[5] and Ward DH^[6] described the use of a 'continuous proportion' or 'repeated ratio', which is established between the width of the central and lateral incisors and continues in the placement of the remaining teeth and spaces. Ward DH^[6] termed it as the recurring esthetic dental (RED) proportion and recommended that this proportion be used more consistently while moving distally in the arch rather than the 62% proportion (golden proportion).

TOOTH-TO-TOOTH PROPORTIONS

The first golden proportion association and the most important to be discovered, is that the width of the central incisor to that of the lateral incisor is within the golden proportion. The width of the lateral incisor to that of the canine is also within the golden proportion, as is the width of the canine to that of the first premolar. Therefore, the teeth in the anterior esthetic segment (from the first premolar on one side to that on the other side) are within the golden proportion to each other as observed from the front.^[2] This phenomenon has been combined in a grid, called the diagnostic grid or the golden proportion grid, which can be used to assist in perfecting the esthetics of the anterior teeth [Figure 3]. These grids are available in seven sizes to accommodate all widths of the central incisor from 7 to 10 mm in steps of ½ mm.

GOLDEN PROPORTION AND THE LIP LINE

In a relaxed face, when the teeth are not touching together (when the lower jaw is in the resting position with free-way space present), the lip line divides the lower third of the face into the golden proportion. The space between the bottom of the nose and the bottom of the chin is divided by the lip line into a 'chin-to-lip line' (the larger portion) and a smaller portion, the 'lip line to below the nose' [Figure 4]. This proportion could be used in prosthetics for assisting in determining the height of the incisors. If used in conjunction with phonetics and disclusion, no complications should arise in the positioning of the 'incisal edge'.

WIDTH OF THE ARCH SHOWING WHILE SMILING

The analysis of any pleasant smile would show that the teeth do not extend right to the corners of the mouth

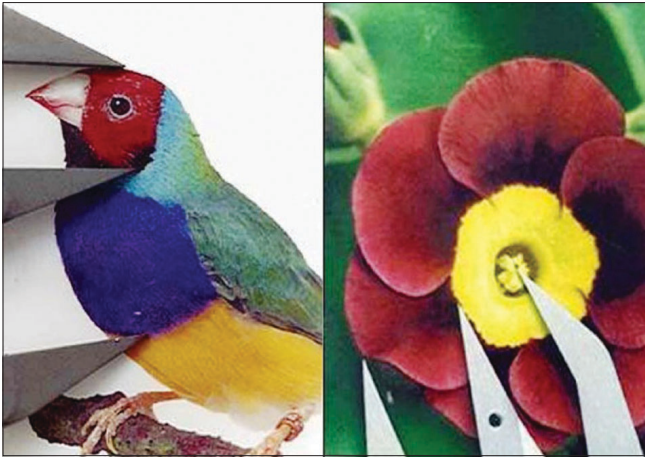


Figure 2: Golden proportion calipers showing the dominant color separations in a bird (left) and in a flower (right) in golden proportion

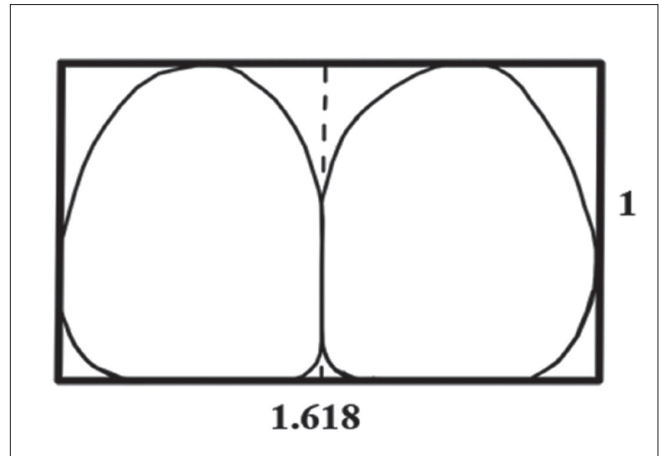


Figure 5: The golden rectangle of the central incisors



Figure 3: The diagnostic grid demonstrates the golden proportion in the anterior esthetic segment



Figure 4: The golden proportion in the lower third of the face showing an ideal position of the incisal plane



Figure 6: Unesthetically exposed roots (A) covered with artificial gingival prosthesis to restore the esthetics (B) in accordance with the principle of the golden proportion

but actually stop at a distance from them. Thus, there is an area of neutrality or darkness between the teeth and the corner of the smiling mouth. Between these two neutral spaces lies the anterior esthetic segment.

The neutral space is a dynamic space, which appears in a broad smile and can be defined as a bilateral space bounded laterally by the corner of the smiling mouth and medially by the dental arch. In a pleasing smile, the anterior esthetic segment is in the golden

proportion to the width of the smiling lips.

The anterior esthetic segment, from the first premolar to first premolar, is highlighted against the backdrop of the smiling lips, with two neutral portions located laterally between lips and teeth. The grid also shows that the corner of the arch divides the smile into a larger tooth portion and a smaller neutral space [Figure 3] and thus gives another indication for arranging the visual effect of this important corner.

THE GOLDEN RECTANGLE OF THE CENTRAL INCISORS

The golden rectangle was given by Dr. Stephen Marquardt who discovered that 'The height of the central incisor is within the golden proportion to the width of the two central incisors' [Figure 5]. This revelation has offered solutions to a host of dental esthetic problems since it has provided a formula for evaluating the horizontal against the vertical. Unsightly, exposed roots can be covered with a gingival prosthesis (artificial gingiva) to bring the gingival level down to establish a golden rectangle on the central incisors and restore the esthetics [Figure 6].

CONCLUSION

Regardless of the science, the golden ratio retains a

mystique, partly because excellent approximations of it keep appearing in many unexpected places in nature. The golden proportion is an element of design that a surgeon should be aware of. An understanding of this enigmatic proportion that has long stood for beauty may provide us with useful guidelines that can be combined with our existing knowledge and applied to our dental work for restoring dental esthetics with reasonable assurance of success.

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