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# Vitruvian Man - Leonardo da Vinci's Interpretation of the Golden Proportion and its Application in Modern Dentistry

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# Vitruvian Man - Leonardo da Vinci's Interpretation of the Golden Proportion and its Application in Modern Dentistry

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## Abstract

Leonardo da Vinci's drawing 'Vitruvian Man' has captured the imagination of generations while, at the same time, confounding them with its meaning. Upon casual inspection it appears to be merely a masterfully drawn representation of a male figure with odd handwritten notes and various geometric figures about it. In actuality, Leonardo placed in his drawing a shrouded message which, by his lifetime, had already been passed down among the masters for approximately two millenia. This message is pertinent today, in the twenty-first century, as dentistry strives to produce restorations which approach that which nature itself has created.

The breadth of Leonardo da Vinci's work is staggering. The life's work of Leonardo traversed a diverse spectrum from mechanics to sculpture, from anatomy to painting, from architecture to drawing. The breadth of his work and knowledge was awe-inspiring. However, his immense collection of works was merely a by-product of his superlative intellect. Throughout the centuries scientists and historians have attempted to make some sense of Leonardo's intellectual abilities. In order to attempt to grasp the magnificence of both Leonardo's intellect and its offspring, his creations, one must not focus solely on the amazing breadth of his work but also its depth.

The majestic beauty of Leonardo's works rests in the marriage of seemingly unrelated disciplines. Leonardo took disciplines which even today appear to be unrelated and coalesced the two into a finished product which was not only technically perfect or only artistically without equal. Leonardo had a multi-disciplinary approach to his work and this is what breathed life into his creations and separated his work from that of the other masters.

Nowhere in Leonardo's vast compendium of works is this marriage between multiple disciplines more apparent than in his drawing, 'Vitruvian Man'. 'Vitruvian Man' is Leonardo's ciphered prescription to future generations to decode his secret for bringing a lifelike quality to his work. This quality in one's work is oft-desired by many various professions and artisans

but, yet, is so rarely obtained. These highly skilled and proficient practitioners of various disciplines usually always fall short in their pursuit of that elusive quality which would transcend their work from mere excellence to the realm of a higher entity.

In 'Vitruvian Man' it is almost as if Leonardo himself is delivering a coded lesson to modern dentists. He is demonstrating to us that the scientific aspects of the dental profession must exist in concert with its artistic aspects in order to provide the elusive breath of life into the visceral creations of the dental profession.

Leonardo instructs us, in extreme detail, how to transform our creations (i.e. veneers, crowns, etc.) from a technically superior piece of craftsmanship into an object which approaches that which it has been meant to replace.

## Vitruvian Man

The 'Vitruvian Man' may not be recalled by title, but the image itself is undoubtedly recognized: A man superimposed on himself in two different limb orientations. One standing in a square with arms outstretched and the other with legs and arms angled open inside of a circle. This pen and ink on paper drawing was completed by Leonardo around 1490.

Leonardo created this work based on the writings of Marcus Vitruvius Pollio, a master architect in the Roman Empire. As an engineer of Roman invention, Marcus had described the art of proportions, including that of a man, in a collection of books called 'De Architectura'. 'De Architectura' is broken down into ten different books which examine architecture, machines, and city planning. Many artists had tried to illustrate the perfect proportion of man based on the description, but only Leonardo was successful. Leonardo's drawing is accompanied by his notes which were based on the works of Marcus Vitruvius Pollio. This handwriting might look strange to the casual observer because Leonardo wrote them in mirror-writing which was his custom for all his writings except those he would be giving directly to others.

The following is a complete translation of the text that accompanies the image: 'Vitruvius, the architect,

says in his work on architecture that the measurements of the human body are distributed by Nature as follows that is that 4 fingers make 1 palm, and 4 palms make 1 foot, 6 palms make 1 cubit; 4 cubits make a man's height. And 4 cubits make one pace and 24 palms make a man; and these measures he used in his buildings. If you open your legs so much as to decrease your height 1/14 and spread and raise your arms till your middle fingers touch the level of the top of your head you must know that the centre of the outspread limbs will be in the navel and the space between the legs will be an equilateral triangle.

The length of a man's outspread arms is equal to his height. From the roots of the hair to the bottom of the chin is the tenth of a man's height; from the bottom of the chin to the top of his head is one eighth of his height; from the top of the breast to the top of his head will be one sixth of a man. From the top of the breast to the roots of the hair will be the seventh part of the whole man. From the nipples to the top of the head will be the fourth part of a man. The greatest width of the shoulders contains in itself the fourth part of the man. From the elbow to the tip of the hand will be the fifth part of a man; and from the elbow to the angle of the armpit will be the eighth part of the man. The whole hand will be the tenth part of the man; the beginning of the genitals marks the middle of the man. The foot is the seventh part of the man. From the sole of the foot to below the knee will be the fourth part of the man. From below the knee to the beginning of the genitals will be the fourth part of the man. The distance from the bottom of the chin to the nose and from the roots of the hair to the eyebrows is, in each case the same, and like the ear, a third of the face.'

Leonardo viewed his studies of the human body as a 'cosmografia del minor mondo'- a cosmography of the microcosm. This can be clearly demonstrated in 'Vitruvian Man' in which Leonardo viewed the human body to be an analogy for the workings of the universe.

#### PHI, THE FIBONACCI SEQUENCE, THE GOLDEN PROPORTION AND MODERN DENTISTRY

Plato was subject to the Pythagorean oath of silence which prevented him from directly revealing certain secrets. In turn, Plato posed certain questions in hopes of guiding an individual towards enlightenment (1). In 'The Republic' (2) Plato asks the reader to "take a line and divide it unevenly". Plato is urging the reader to seek a ratio whereby the whole to the longer equals the longer to the whole. Plato, in such a circumspect and shrouded manner, is leading the reader to the most absolute and unencumbered formula for the desired outcome of a harmonic balance in nature and, after mathematically solving Plato's

geometric puzzle we are left with a very special geometric ratio which is expressed numerically as 1.6180339... In 'Vitruvian Man' Leonardo, in a much more straightforward manner than Plato, is imploring us to understand one basic law of nature. He is stating that, numerically, 1.6180339... equals beauty. This irrational number has become known as 'phi' (3).

Leonardo Fibonacci (c 1175-1250) was a mathematician who was born in Pisa. He travelled extensively as a young man and returned to Pisa, in 1200, to write 'Liber Abaci'. In 'Liber Abaci', Fibonacci introduced a certain rhythmic number sequence.

The Fibonacci Sequence begins with 0 and 1. The next number is obtained by adding the previous two numbers (eg 0,1,1, 2, 3, 5, 8,13 , 21, 34, 55, 89,144, 233, 377, 610, 987,1597 (4). The Fibonacci Number Sequence is a linear recurrence equation represented by  $F_n = F_{n-1} + F_{n-2}$  (4, 5).

As the Fibonacci Sequence progresses, the result of one number in the sequence divided by its predecessor is equal to a number that approaches phi (1.6180...) (eg. 377/233). This ratio increases in resemblance to phi as the numbers in the Fibonacci Sequence approach infinity.

The Golden Proportion has been known for millenia. It was proven by Plato with the construction of the golden rectangle. In this golden rectangle the golden proportion is expressed as  $AB:AC=CB$  or  $AB/AC=AC/CB$ . Mathematically, the golden proportion =  $(1 + \sqrt{5})/2$  (6,7). Hence, the simultaneous additive and multiplicative nature of the golden proportion is expressed as a simple quadratic equation where phi is shown to be equal to 1.618033987749...

The goal of modern dentistry is to preserve natural tooth structure and anatomical structures of the oral region. When this is not possible dentistry aims to replace such natural substances in a manner which mimics nature as close as possible with regard to both form and function. Da Vinci, in the "Vitruvian Man", demonstrates what a usual tool the golden proportion is in such a pursuit. This is true from the obvious uses in the various restorations of esthetic dentistry to the less apparent utilization in the craniofacial mappings of orthodontics and oral and maxillofacial surgery.

Various practitioners have applied the principle of the golden proportion in differing manners. A golden caliper has been manufactured whose goal is to aid in the determination of both tooth size and arch form (6).

Levin (7) has demonstrated the usefulness of the golden proportion in the construction of complete upper dentures.

There are many diverse facets of modern dentistry yet,

inherently, each strives for the same goal- to replicate the natural anatomy to a degree which has not been seen previously.

## Conclusion

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Twenty-first dentistry strives, with remarkable results, to produce the most life-like and realistic restorations for our patients. This ranges from composites to various ceramic restorations. The dental profession has reached staggering heights in its ability to provide esthetic, reliable, and highly functional restorations for its patients by means of the wonderful technology at its disposal. Every field of dentistry aims to preserve the patient's natural structures wherever possible.

Dentistry aims to replace diseased bodily entities in a manner which replicates, in a healthy state, that which must be removed as closely as possible. Leonardo's 'Vitruvian Man' is not merely a magnificent rendering of the human form by the grand master himself.

Rather, it is Leonardo's cryptic lesson which has traversed the centuries to those who choose to elevate their understanding of the basic elements of human form. The lesson of Leonardo's 'Vitruvian Man' reminds us that we still have a goal in common with the masters of the Renaissance- to breath the fire of life into our own creations.

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