

A Philadelphia Fable: How Ideal Occlusion Became the Philosopher's Stone of Orthodontics

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Just as alchemists in the Middle Ages searched for the “philosopher’s stone,” a mythical substance that, in addition to transforming base metals into gold, would be the panacea for human ills, so did orthodontists of the 19th century seek to decipher nature’s grand plan for the arrangement of the dentition that would serve as the touchstone for the emerging field of mechanical regulation of irregularities of the teeth. At a meeting of the Philadelphia Academy of Stomatology in 1898, Edward H. Angle proposed that orthodontics be based on the science of dental occlusion and offered a definition of normal occlusion as the ideal to be attained in the treatment of malocclusion. A year later, his landmark declaration appeared in *The Dental Cosmos*, the leading dental journal of its day, which was published in Philadelphia, as were almost all American dental journals at the time.

Although Angle’s ideal occlusion became widely accepted as the goal of orthodontic treatment and the basis of normal dental function and oral health, it was not until 75 years later that the first serious attempts were made to examine the validity of this engaging and useful hypothesis. Over a period of several years, the National Institute of Dental Research and the National Research Council of the National Academy of Sciences assembled 3 independent panels of orthodontic experts to evaluate research related to malocclusion,¹ variations in dental occlusion,² and disabling orthodontic conditions.³

The conclusions drawn by these panels were, respectively: (1) a precise and clinically meaningful definition of malocclusion did not exist; (2) progress toward measuring the effects of variation in dental occlusion was hampered by the lack of a clinically useful definition of occlusion and an adequate means to describe it; to correlate variations in occlusion with variations in dental health, it would be necessary to describe—and preferably quantify—variations in occlusion; (3) the degree of interference in function or appearance that might result from imperfect or abnormal occlusion could be determined only in relation to symptoms, not by morphologic variations or signs, as is the case with all current indices of malocclusion and orthodontic treatment need. Thirty years later, no fur-

ther attempts have been made in the United States to resolve this matter.

Because of the strong attachment of clinicians to ideal occlusion, there might be value in tracing the history of the “science” of occlusion and describing the dental, scientific, and cultural milieu in which this concept was conceived. The role of Dr William Gibson Arlington Bonwill, a legendary 19th-century dentist who was then a leading light in Philadelphia dentistry (albeit a controversial figure), is particularly germane. Bonwill began his dental career as an apprentice, first to a Dr Neall and later to Dr Chapin Harris, who was the cofounder and inaugural dean of the Baltimore College of Dentistry, the oldest dental school in the country. Bonwill patented the first anatomical articulator in 1858, some years before he enrolled in the Pennsylvania College of Dental Surgery, from which he graduated in 1864, 12 years before Edward H. Angle. Bonwill taught at the college during Angle’s student days. By the time Angle enrolled in college, Bonwill had published widely on several dental topics, including orthodontics. Albert Ketcham, an Angle student in 1902, recounts a story that he presumably heard from Dr Angle. While sitting in a lecture given by Dr Bonwill, a younger Edward Angle reflected, “if there is normal occlusion, then I can classify malocclusion.”⁴ Based on Bonwill’s theories and writings, it is highly likely that he was influenced by Freemasonry. We know that his father, a noted Delaware physician, was buried in Dover in 1864 with full Masonic rights. The well-known Masonic symbol of a G within a Mason’s square and compass graphically symbolizes Bonwill’s beliefs about the geometric basis of dental occlusion. The Masons do not refer to God but instead to “the great architect of the universe,” and the “G” in their icon stands for geometry, not God as many have assumed. Among Bonwill’s contributions to dentistry, he was proudest of his “divination” of the tripod arrangement of the mandible, which formed a 4-inch equilateral triangle and explained both jaw function and how the teeth should articulate. For Bonwill, this became the key to the revelation of nature’s inner workings, with a belief in the Divine Architect, whose “intelligent design” was manifest in the articulation of

the teeth. His paper “The scientific articulation of the human teeth as founded on geometrical, mathematical and mechanical laws” summarized almost all of Bonwill’s previous writings and appeared in the year of his death (1899).⁵ In it he said, “I see the work of the great Creator, who could design and construct such a marvelous and simple piece of mechanism.” In the 17th and 18th centuries, this concept had become known as the “watchmaker analogy” and was an attempt to explain the structure of the universe and its Creator’s relationship to it. The notion that proof of God might be achieved through direct intuition became a central tenet of natural theology, an outlook that lost many of its adherents in Europe after 1859 with the publication of Darwin’s *On the Origin of the Species by Means of Natural Selection*. Bonwill believed that he had advanced an argument to counter Darwin.⁶

Despite the bewilderment of most of his colleagues regarding his arcane theories, Bonwill’s technical ability was greatly admired, and it is apparent that his work strongly influenced Angle. Nonetheless, when Wilbur Litch, editor of *The Dental Brief*, wrote of Dr Bonwill after Bonwill’s death, he did so with surprising candor: “Dr Bonwill was not the first man of talent who has been lured in the shadowy paths of speculative mysticism by the powers of numbers and the proportions of geometric forms; the pyramid, the triangle and the sphere and those ‘mystical numbers’ five and nine and three. All have had their cults, to whose initiates, in some occult and esoteric sense, each has seemed an effluence from the Deity.”⁷

This background demonstrates that the “science of occlusion” emerged from a pseudoscientific tradition already characterized in the 19th century as “composed merely of so-called facts connected together by misapprehension under the disguise of principles”⁸ and that, from the beginning, there were strong overtones of religious belief in the concept of occlusion. Although neither Bonwill nor Angle was known for a sense of humor, their work evinces a lighter touch: considered as an anagram, the term “occlusionist,” indirectly attributable to them, may be reassembled to declare “so occult is in”!

An important indicator of pseudoscience is that it is not based on standard, understandable, and unambiguous definitions of concepts. For instance, the statement “ideal occlusion is the primary basis of a healthy stomatognathic system” seems, on the surface, to be a testable scientific hypothesis. However, the definitions of “ideal occlusion” and “healthy stomatognathic system” are so vague and imprecise that no substantial scientific evidence for or against this hypothesis has been produced in the century that has elapsed since these concepts took hold following the pronouncements of Bonwill and Angle. The very idea that

these concepts might be scientifically invalid is so improbable to many dentists that they seem not to warrant exposure to scientific scrutiny. Nonetheless, if occlusion is to stand as a foundational principle in clinical dentistry, it behooves the dental profession and the specialty of orthodontics to examine whether one of their core beliefs is valid under 21st-century standards of biological sciences. Our contention is that although the Bonwill/Angle hypothesis has practical utility, its scientific validity is yet to be resolved. With the growing insistence that orthodontic practice be evidence-based, we ask whether a long-standing fundamental belief should be put to the same robust test. Perhaps the principal orthodontic quest early in the 21st century should be to show clearly and irrefutably the physical, psychological, and social benefits of orthodontic treatment, since we know already that the risk of adverse reactions to modifying tooth positions and occlusion is quite low.

More than a hundred years after Bonwill and Angle, the digital era has allowed technology to again trump biology. The quest to design computer-generated custom appliances that are ever more precise and that aim to establish more “perfect” tooth position and occlusion is reminiscent of Bonwill, with his naive geometry and beloved articulator. Fortunately, our patients understand that the aim of modern orthodontic treatment extends beyond the illusion of perfect and immutably stable occlusion. Our specialty needs to strive to place occlusion into an appropriate scientific perspective and to focus on the benefits of treatment in a broad sense. A departure from the dogma of ideal occlusion does not reduce contemporary orthodontists to “de facto cosmetologists”⁹ but rather frees them to enhance a patient’s dentofacial appearance and, in some cases, oral function. It opens the way to establishing a scientifically sounder model of occlusal function and oral health. Regrettably, some orthodontists, to paraphrase W.C. Fields, would on the whole rather be in 19th-century Philadelphia!

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Erratum

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Six-Month Bracket Survival with a Self-Etch Adhesive

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Part of the Results paragraph in the Abstract was incorrect as printed:

Results: The failure rates of the self-etch and conventional adhesives were 10.6% and 7.4%, respectively. The failure rate of the conventional system was 0.3 times greater than that of the self-etch system.

Those sentences should read as follows:

Results: The failure rates of the conventional and self-etch adhesives were 10.6% and 7.4%, respectively. The failure rate of the conventional system was 0.43 times greater than that of the self-etch system.

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