Editorial

Biologic Width: A Physiologically and Politically Resilient Structure

The value of scientific knowledge is without question; however, our approach to such knowledge can be questionable. One problem with scientific data is that it is relatively easy to generate large volumes of numbers, and this can be a very real problem. It is also difficult to interpret the data and how to teach/learn it. Take, for example, the body of knowledge required for graduation from dental school. This knowledge includes an extremely wide range of information, combined with those skills and values required by the American Dental Association's Commission on Dental Accreditation, which makes the task of achieving a competent level in all aspects in 4 years of study almost impossible. For these reasons, students are forced to learn (memorize) synopses of a lot of data, including the famous "bottom line" of a study, which in turn usually means memorizing averages and means of the data. Most realize early on that this is a necessity of the educational process and that a quick look at the standard deviation allows one to appreciate the variability in the data set. However, it is curious how some data seem to be repeatedly "picked on" with regard to how it is regarded over the years.

Such data include the numbers associated with "biologic width." Gargiulo et al[1] published observations on the linear dimensions of epithelium and connective tissue surrounding teeth in 1961. Most students have conveniently memorized the "bottom line" that sulcus depth is on average 0.69 mm, the length of epithelial attachment is 0.97 mm, and that the connective tissue attachment is 1.07 mm. These numbers, of course, represent only the average of all examined data, which included human autopsy specimens from Dr Balint Orban as well as an additional 30 human jaws taken at autopsy as block sections. From this material, 325 surfaces were measured histologically for 6 different measurements, yielding a total of 1,950 data points. Given such a large number of measurements, it is easy to understand why students remember only the bottom line—the means listed for sulcus depth, epithelial attachment, and connective tissue length.

The true value of this scientific data (similar for virtually all scientific data) is the context in which it was produced. In the 1920s, Gottlieb[2] described the epithelial attachment to teeth, and his students[3] tried to understand the epithelial attachment by measuring its dimensions. In the 1950s, Waerhaug[4] questioned the epithelial attachment, and a discussion ensued for almost a decade as to the structure of the gingival sulcus and epithelial attachment. In 1959, Sicher[5] described a "dentogingival junction" in which he conceived of a "physiologic division of labor of supporting tissues." Such a concept allowed for both a connective tissue fibrous attachment of the gingiva and an epithelial attachment. Thus, the 1961 paper on the dimensions and relations of the dentogingival junction in humans[1] provided for the first time a detailed evaluation of the linear dimensions of all three com-

ponents (the sulcus, epithelium, and connective tissue) under healthy conditions, and importantly, although most don't remember since it's not part of the "bottom line," it confirmed Stanley's observation in 1955 that the most variable dimension of the dentogingival junction was the epithelial attachment, with the connective tissue length being the most constant.[6]

Thus, the original article on biologic width by Gargiulo et al[1] was landmark in its detail and establishment of physiologic dimensions of the dentogingival junction and the relationship of its components. However, out of necessity due to the volume of dental knowledge, many simply learn the mean values published in the article. The overall significance is related to the fact that these biologic dimensions have implications for both periodontal and restorative procedures. From a periodontal perspective, these dimensions are crucial to understanding the etiology and pathogenesis of periodontal disease, especially considering the paradigm shift that has occurred in the latter. Furthermore, restorative procedures often encroach or penetrate ("violate") the dentogingival junction and as such constitute a periodontal concern for the restorative dentist. In a recent commentary in the *International Journal of Prosthodontics*,[7] the biologic width dimensions were considered an "inconvenient truth." In fact, the commentary states, "Moreover, dentists are taught that 'the science' on the subject is settled and that biologic width is indeed a reality," suggesting that neither are true.

It is hard to ignore that biologic width does indeed exist and is a reality. When does anatomy and physiology become an "inconvenient truth"? The dimensions of the epithelium and connective tissue are histologically determined from multiple species and represent a physiologic structure where teeth penetrate the integument, ie, go from inside the body to outside. The biologic width is responsive to physical and chemical challenges just like other aspects of human anatomy and physiology. When skin is broken or punctured, there is a predetermined physiologic response of inflammation and wound healing and sometimes an anatomical change in the form of a scar. When plaque forms, an inflammatory response with very specific factors occurs[8] that can result in tissue remodeling (including bone loss) if certain spatial and timing issues occur.[9] As humans, we have inherent physiologic and pathologic reactions, and it is hard to understand why periodontal and peri-implant tissues are viewed differently.

The scientific literature also supports that a biologic width forms around dental implants—another oral structure that penetrates the integument. For example, we have described the length of the epithelium and connective tissue around nonsubmerged dental implants where the dimensions were determined histologically around unloaded and loaded implants in the canine mandible.[10] Two papers described these dimensions around implants with different configurations[11] and over time.[12] Two more peer-reviewed published scientific papers described the inflammatory response of these tissues.[13,14] While our studies have focused on the canine model, there are many other published scientific papers on both teeth and implants that clearly demonstrate histologically and scientifically that biologic width is indeed a reality.

The biologic width dimensions represent anatomical and physiologic tissues where the host responds to physical (eg, restorative margins, abutments, and microgaps) and environmental (eg, bacteria and chemicals) challenges through the initiation of inflammation and, under pathologic conditions, tissue change. Restorative dentists need to take into account that these are responsive biologic tissues and that impinging on them has consequences. Memorizing the mean dimensions may be a good strategy for learning, but few would not recognize that great variability exists in these dimensions just the same as the mean weight of a man or woman or, for that matter, the dimensions of the dental golden proportion. While the fact that the "biologic width" exists and has important consequences for dentistry might be "inconvenient" for some, its significance and existence should not be.

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