DENTAL ENGINEERING—IS IT JUSTIFIED?

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IT is my purpose, at this time, to treat, philosophically, the general aspect of present day orthodontia. I shall not, while so proceeding, allow egotism to mar our searching and reasoning.

If it happens to devolve upon me just now to lead in the propagation of the science of dental engineering, I bespeak, for myself the sympathy, rather than the envy or jealousy of the profession, for I seek nothing but its enlightenment and progress. I shall adopt the plural, for I am now conscious of the moral support of the best brains in the profession, and shall never again have to stand alone in defense of my doctrine.

We shall take as a basis for our philosophic reasoning today, an article "Dental Engineering and the Normal Arch" in the *Dental Cosmos* of June, 1918. We shall assail the article in a manner exactly as if it were anonymous. We must show and prove the fallacy of pseudoscience. Be assured that whenever this counterfeit dares to distort in the sun of science it will suffer annihilation. Permit us to cite: "Dental engineering is a term which has been applied so often in describing orthodontic treatment during the past three years that the expression has found a permanent place in dental literature. If we are to accept dental engineering and allow it to become a part of our science, it is well that we clearly understand what it means, and its relation to Nature's methods of arch construction. In the first place, all branches of engineering are based upon exact mathematical formulæ, and variations are always considered. Nothing is allowed for variation until the amount of variation has been carefully computed. The finished product must comply absolutely with the predetermined result.

Engineers always assume that if no error has been made in the mathematical calculation, the desired work can be accomplished, and right here we meet the first obstacle in applying engineering methods to orthodontia."

This rendition presents engineering as a dogma, which it is not; permit us, therefore to present it as a *science*, which it is. There is not an engineer in this wide world—not one who deservedly attained his degree—who does not allow, in his calculations, for natural contingencies, of which there are many; and the greater and more learned the engineer, the more circumspect will he be in making these allowances. Let us take, for example, the planning, of a cable-suspension bridge. We shall not go into wearisome details, but state briefly, and lucidly, the most important factors. The bridge is to be held by four cables. After computing the total weight to be borne by the cables, the carrying strength of the cables is scientifically calculated. After that, allowances are made, in addition to mathematical certainties, and, in making allowances, science and Nature are linked. The engineer will reason with himself as to the contingencies which Nature will sooner or later provide and which

may impair its carrying capacity. There are, of course, many contingencies which Nature,—not science—brings about, but all thinking men know that competent engineers must, necessarily be scientific, and that they must and do reason with Nature as to her terms—present and future. Nor do competent engineers ever neglect, after having contemplated a safe structure, to create it as beautifully as is consistent and harmonious with surroundings and perspective and with the funds available for the purpose. Every engineer, worthy of the name, leaves nothing, absolutely nothing, to chance; neither does he depend on Nature, for Nature is both creative and destructive; he simply adheres to scientific principles, and goes so far as to anticipate and correct the shortcomings of Nature. Exactly what the modern orthodontist should try to do.

We shall hereafter be so forcible in conveying scientific doctrine that “reactionaries,” and “straddlers” will not assail science without the danger of being classified as outside the pale of science. We shall put forth the laws of physics, the tenets of applied science, and the reasoning of an unshakable philosophy. We have heretofore, refrained from taking this advanced stand, but now that we are assured of the moral support of a goodly number of practicing orthodontists and students—men of open mind who prefer to learn truth, rather than stick to false prophets—we shall proceed to preach the gospel of science in a way which will attract the seekers after light and repel all others—especially the straddlers who deal out thick hunks of bread of ignorance covered with a grudgingly sparse layer of the butter of science.

The writer of the aforesaid article deprecates the enterprise of scientists who dare destroy the idols of ignorance and mediocrity, and he, in grandiloquent fashion, confounds them with the astounding indictment: “Fools rush in where angels fear to tread.” It does not take a very keen sense of discernment to determine that our friend has ranged himself with the angels, and, it does not require superheroism on our part to insist upon living up, with the fools—nor are we the first and only fools in the “rush” line. Socrates, Columbus, Newton were fools who rushed in where angels feared to tread. We do not claim to be *such* fools as those we named, yet we emphatically disclaim all relationship to the angels.

Lest a false impression obtain that injured pride causes us to attack those who dare assail us, let it be stated, as a matter of fact, that the foregoing is a counter attack, in other words, a defensive stroke, calculated to parry an attack upon science. While such offense could not, possibly, penetrate the armor of science it might—if not thrown back—injure many recruits of science, and destroy much human material worth saving, including possibly the aforesaid oracular author himself.

It is our avowed purpose—paradoxical as it may seem—to convert the angels, and make it possible for them to enter the kingdom of fools. Our catechism of conversion may be terse and tough, but this is justified by the certainty that we can not make scientific thinkers and workers out of vague, scintillating bipeds by feeding them delicious angel food. They must be made to quaff copious drafts of physics in order to condition themselves for

the comprehension and adoption of science. We, on our part, shall keep up courage, and look hopefully forward to the time when many of the present-day scoffers will sincerely endeavor to obtain a fool's license.

We shall not try to correct or clarify some of the passages in our friend's article, because, frankly, one can not make head or tail out of them, and there is, moreover, a general aversion to the dissecting of hash. We will, however, take up the paragraphs which are sufficiently clear, for the purpose of demonstrating certain truths.

He writes: "Engineers always assume that if no error has been made in the mathematical calculation, the desired work can be accomplished, and right here we meet the first obstacle in applying engineering methods to orthodontia. In the first place, Nature does not grow flowers, animals, human beings, or dental arches to mathematical exactness—the almost infinite number of variations is one of the charming things in Nature; but, while not arbitrary, she does follow certain well-defined laws."

We observe that the distinguished author sets up the pins of a pre-science era in a neutral alley, and then, (unconsciously, we presume) straying into the fools premise, proceeds to bowl them over,—all of them, with *lignum vitæ* formed into a sphere of science. We applaud the "ten strike," but we deprecate the waste of energy which the setting up of the pins necessitates. He states a truth when he says: "Nature follows certain well-defined laws." We agree. Nature does follow certain well-defined laws. Nature *does* grow flowers, animals, human beings and dental arches in accordance with certain well-defined laws. *If, however*, Nature, in the growing of a certain dental arch, through influences which may or may not be readily determinable, has strayed from the course of those certain well-defined laws, then it becomes the mission and duty of the scientist to correct Nature, or, rather, bring strayed Nature back to herself, and that, precisely, is what we intend to do, and will do.

Our friend writes: "Another and more serious difficulty in applying engineering methods to orthodontic treatment is that, once we adopt them, we become slaves to a system which is so exacting that it becomes impossible of realization." We reply: A system—though it be exacting is system; while so-called systems which are not exacting are not systems at all. And, if for the time of apprenticeship, we are made slaves to system, this transitory stage should be cheerfully endured in order that, after apprenticeship, the erstwhile slaves of system may become its masters—and this eventually is our goal. Let us read further: "Dental engineers work under the assumption that teeth can be moved to within one one-thousandth of an inch of some predetermined points, and rest their assumption upon the ability of the operator to move and place cusps, sulci, and planes in the exact position as shown on the previously laid-out chart." This is a specie of levity which can but spur us on to greater seriousness, and to the resolve to repel all attacks upon our science—whether direct or indirect—so that innocent readers who aspire to the attainment of knowledge, may not be misled, but on the contrary saved to science. We are, in this instance, constrained to observe that dental engineers only "assume"—and forever "*assume*"—that it is always not only a wise expedient, but also an

absolute law that the point nearest the truth and nearest perfection be attained, and we shall maintain this position, even at the risk of discomfiting metaphysicians, or quacks who prefer to grope along dark by-ways that they may go on practicing make-shifts amid the fogs of uncertainty.

We now proceed to a remarkable paragraph, one that pulsates with the epigrammatic wisdom of the oracles: "The proverb that 'Fools rush in where angels fear to tread' can be appropriately applied to the man who knows all about engineering, but little about orthodontic treatment. Such a man gets an idea and allows it to dominate him, distorting his judgment and pushing aside every other consideration to accomplish the purpose." Who among those of us who prefer to align with the fools is so immodest as to see this oracle's finger pointed at him? Let the man who knows little about orthodontic treatment but who knows all—all, mind you—about engineering, rise, that we may acclaim him; for he who knows all about engineering is deserving of the laurel, being, as it were, in a class by himself as an engineer, and, as to little about orthodontic treatment, he is in a class with at least 75 per cent of practicing orthodontists of the present day.

We read further: "Most of us who have moved teeth for any length of time know that when we place teeth in positions which approximate occlusion, Nature comes to our aid, and by means of dynamics and the inclined planes proceeds to occlude the teeth, and she can do with her methods what man has failed to do since time immemorial. It is fortunate for most of us that this is true, and it is my contention that even if man possessed the ability to place cusps to within $\frac{1}{1000}$ of an inch of the position as indicated on a chart, this is wholly unnecessary." We must again accentuate that it is not only desirable but imperative as well that, to the utmost of our ability, we approach truth and perfection, for this task is imposed upon us—not alone by science, but also by good morals. When our friend declaims upon the work which Nature does gratis for man, we—all of us—join in praise of and gratitude to Nature, especially those of us who are scientific enough to comprehend that if Nature ever "went on a strike" there would become visible on the horizon of all who are not blind, an endless line of impotent, groping, demoralized practitioners of orthodontic guesswork. Luckily, we are happy to say, there would appear, also, upon the horizon, a beacon of light, in the form of a small—a very small—minority of orthodontists, practitioners who had been seekers after truth, slaves of system who had never been satisfied to drift with the mediocre, and who had never descended to the level of the scoffer; and upon this small minority would devolve the task of delivering, through acquired science, suffering humanity, upon them would fall the task of setting right the multitude of their erring brothers who forever depended and depend upon Nature to come to their aid, to correct their malpractice, to smooth over their rough work, and who never, or very rarely, volunteer, on their part, to come to the aid of Nature and thus to live on terms of reciprocity with her. We reiterate: It is our everlasting purpose to assist Nature in order that we may approximate the perfection which is her goal and that, also, of scientists everywhere.

We are further instructed, as follows: "It is of course true that occlusion is largely a mechanical problem, and as such it is closely related to mechanical engineering, but we must always have in mind that a working formula to be of any value must be capable of execution. That there has been and still is a need for some method of predetermining the shape of the arch none of us will dispute." In this paragraph our friend comes dangerously near deserting the camp of the angels, and dropping into the trenches of the fools. If he persists in this careless abandon we may yet capture him. He continues: "Ever since orthodontia became a specialty the need for this has been constantly seen, but little has been done to that end. For years the Hawley charts remained the only guide for arch form, and we must concede that they were better than nothing." In the vernacular—What do you know about that? Our friend actually admits that it is better to have order than to have chaos. Good! On the same hypothesis: if order is desirable, is not system more desirable, and science most desirable?

Our friend complains: "We have for a long time paid altogether too much attention to designing appliances and perfecting technic without due regard for a great and fundamental problem, that of determining arch form. The ease with which the profession becomes obsessed with a desire to perfect technic was seen some years ago when members of the profession reached such a high degree of skill in manipulating noncohesive gold foil, some men even going so far as to fill root-canals with this material. It has since been seen that this took precedence over some equally if not more important problems." We agree, in general, with these remarks; but must demur to the assumption that the activities in so-called "perfecting technic" accomplished, in fact, the perfecting of technic, and we maintain that perfecting technic is possible only if technical perfection—or the approximate equivalent—can be the ultimate result, and that this ultimate result is unattainable unless planned and pursued on purely scientific principles. It follows, therefore, that many activities in the line of so-called perfecting technic were nothing more or less than heterogeneous excursions, inasmuch as they were unscientific, and, hence, could not attain approximate truth and perfection. We do not say that certain appliances which now are discredited, have never led to comparatively satisfactory results, for that would not be consistent with the truth. Moreover, *comparatively satisfactory results are sometimes attained even though wrong hypothesis, wrong diagnosis, and wrong treatments be applied.* Which reminds me of a joke, pardon the digression!

A physician had a patient, a cobbler, who was near death, with typhoid. He told the cobbler's wife that her husband had but a few hours to live. The physician called the next day, presumably, for the purpose of writing the death certificate. He found the cobbler reading, seated in a rocking chair, and laughing most insolently,—the physician thought—over the exploits of Don Quixote. The learned doctor stood and wondered. When, at last, he had convinced himself that it was the cobbler who was holding the heavy volume, and not his ghost, he asked the wife: "How did it happen?" She answered: "He pestered the life out o' me to cook him a mess of sauerkraut, and, you

told me he had only a few hours to live, anyhow, so I thought I might as well let him have his wish. He sure relished that sauerkraut, and after awhile, when I came back into the room, I found him dressed, and reading, as you see him now." The doctor examined the patient, and found him virtually normal and well. He thereupon made the following note in his reference book: "Sauerkraut is a potent specific for typhoid." Some months thereafter the wife of a tailor came to his office, and begged him to come at once to her husband, who, she said, was deathly sick. The doctor hastened there, and found the tailor in the throes of typhoid, his symptoms being almost identical with those of his recovered cobbler patient. He, accordingly, told the wife to feed him a liberal mess of sauerkraut. When the physician returned the next day he found a crepe at the door. He immediately drew his reference book from his pocket, and wrote: "Sauerkraut is good for cobblers but bad for tailors;" hereafter I'll stick to science.

Let us emulate the final resolve of that physician; let us stick to science; let us, hereafter, whenever we are in danger of sidetracking science for guesswork, makeshift or "take a chance" work, recall—for the purpose of stabilizing the scientific tendencies of our intellect—both the sauerkraut joke and the famous, or infamous, appliance joke.

We observe that our friend makes some remarks over which might appropriately float the standard of truth; he does so whenever he hews close to the line of science. As a whole, however, such propaganda is more dangerous to scientific progress than out and out opposition, because it offers to all who read it the flowers of science and progress, so intermixed with the weeds of complacent drifting, and the poisonous toadstools of veiled encouragement to the ignorance-loving stand patters and poison ivy of grudgingly granted truths, that we have no choice but to condemn it as unwholesome diet for all who seek unmixed truth and unadulterated science. Away forever with orthodontic hash!

In order to make orthodontia an absolute science two capital principles must be observed: First, the throwing overboard of all orthodontic quacks, witches, guessers, take-a-chancers, sole-dependents upon Nature, and of all who make their patients the subjects of their ignorance by clumsily experimenting upon them; and second, a strict, faithful, uncompromising adherence to the laws of science,—an adherence which can not and will not tolerate the contaminating association with any and all orthodontic alchemists who mix 1 carat of the gold of science with 23 carats of the mica of quackery, and who then proclaim: "Behold, this is science!"

In order to be able to strictly, faithfully, uncompromisingly adhere to the laws of science, it is, primarily, necessary to have acquired a knowledge of the laws of science. How, then, can this knowledge of the laws of science appertaining to orthodontia be acquired? Through the study and mastery of *dental engineering*.

There are those stand patters who will forever argue that Nature and common sense are the orthodontist's best and most potent allies, to which we reply: "It takes two to make a bargain;" for we believe that Nature and common sense are unwilling to choose, as allies, unprogressive or retrogressive

practitioners. Whatever Nature accomplishes for orthodontia, it does, not because of the inefficiency of the unscientific, but notwithstanding or in spite of it; and as regards common sense, we are sure it would rather be a free lance than be linked with (or defamed by) facile stand patters. We will take the liberty of penetrating the camouflage and of ascertaining the facts. What philosophy teaches that Nature and common sense are opposed by or to science? None! On the contrary, Nature and science are inseparably linked, while common sense indicates the road to wisdom, while wisdom and science are twins.

We do not mean to denounce as outcasts all orthodontists who have not, heretofore, studied, along the lines of *dental engineering*, but we do declare that knowledge of dental engineering is as necessary for the scientific prosecution of orthodontic work as is knowledge of statics, etc., for the work of bridge construction, and that, therefore, the study of *dental engineering* must be taken up by orthodontists, else they will, automatically, be classified as unscientific. It will be our pleasure to cooperate to the end that orthodontists may attain as great a degree of proficiency in dental engineering as either their mental capacity or their moral desire—or both—can encompass.

Utilization of Platinum in Unused Instruments

In view of the limited supply of platinum in the country and of the urgent demand for war purposes, it is requested that every doctor and dentist in the country go carefully over his instruments and pick out *Every Scrap of Platinum* that is not absolutely essential to his work. These scraps, however small and in whatever condition, should reach Governmental sources without delay, through one of two channels:

(a) They can be given to proper accredited representatives of the Red Cross who will shortly make a canvass for that purpose.

(b) They may be sold to the Government through any bank under the supervision of the Federal Reserve Board. Such banks will receive and pay current prices for platinum.

By giving this immediate attention you will definitely aid in the war program.

It is recognized that certain dental and surgical instruments requiring platinum are necessary, and from time to time platinum is released for that purpose. It is hoped, however, that every physician and every dentist will use substitutes for platinum for such purposes wherever possible.

You Are Warned against giving your scrap platinum to anyone who calls at your office without full assurance that that individual is authorized to represent the Red Cross in the matter.

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