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# Taking stock: a century of orthodontics – has excellence been redefined as expediency?

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A cynic is a (wo)man who knows the price of everything but the value of nothing.
Oscar Wilde (1)

The decline and renaissance of orthodontics, since Edward Angle established the specialty at the beginning of the last century, has been profoundly influenced by technological advancements and an increased demand for treatment by adults and children. At the turn of the last century orthodontics was a cottage industry practiced by skilled artisans. One hundred years later, orthodontics is a multibillion dollar service industry and the food industry which was patronized by the parents of children treated by Angle, Tweed and Brodie had skilled chefs in the culinary arts and cheap fast food was limited to a few street vendors. The children and adults who are currently undergoing orthodontic treatment are from families who typically frequent fast food chains known for their wide appeal, limited choices and low cost unskilled labor. Albeit, the 'haute cuisine' still exists, for a price, and as in the past is usually limited to a special occasion where time to spend on conversation and discourse are not considered as a waste of precious time in the daily life of a two career family. This analogy perhaps is too broad but, in the past, the skilled orthodontist would spend considerable time at the chair side fabricating bands, bending archwires to attain tooth movements which the straight wire appliance achieves effortlessly in pre-torque and angulated prescription brackets. Delegating to auxiliary personnel, who engage the pre-formed high tech archwire with fancy colored 'O' rings to the bonded

brackets, is a characteristic of contemporary orthodontic practice in high volume practices which are efficient and dependent on marketing strategies and financial advisors.

The purpose of this paper is to review the past 100 years with possibly a 'jaundiced eye' (2) and relate the role of the orthodontist and clinical practice in a societal context. How the specialty has developed, especially over the past 50 years, has been influenced by the impact of technology and the introduction of a biological basis. Currently, an emphasis on the clinician/scientist relates to the emerging clinical evaluative sciences and evidence-based educational and treatment perspectives.

The role of the contemporary and efficient orthodontist is to conduct treatment in a multiple chair facility and delegate tasks to relatively unskilled personnel. The decline in technical expertise which was the hallmark of an excellent orthodontist was challenged when precious metal and soldering bands and attachments were superceded by stainless steel to which attachments could be welded. The renaissance in orthodontics was heralded by the pre-formed band followed by pre-formed stainless steel and high tech archwires. The need for training orthodontists in long and rigorous technique courses at the start of their apprenticeship in proprietary schools of orthodontia was declining – technical expertise was no longer the driving force in orthodontics and the specialty and its scientific basis had been embraced by university programs for which a certificate and Master's degree was given. By the mid-twentieth century, in the aftermath of World War II, stainless steel was available reducing the cost of appliances and inventory as a more affluent society embraced the 'need' for straight teeth.

Technical advances by the 1970s had resulted in bands being replaced by bonded appliances and expediency prevailed in a cost-effective and efficient environment which would accommodate a high volume of patients. At the same time academic progress in orthodontics was addressing the biological basis to understand the etiology of malocclusion including growth and development of the craniofacial complex. Diagnosis and treatment planning was to become an important aspect in defining the expert orthodontist which inevitably led to orthodontists and craniofacial biologists forming an alliance in understanding the form/function interaction. Defining orthodontics as a biological science as well as an art provided a new and stimulating dimension in advancing the specialty of orthodontics on a biological basis which was not defined solely by technological parameters.

## Orthodontics and craniofacial biology – mid-twentieth century

In a seminal chapter by Carlson (3) on the subject of craniofacial biology as normal science, he questions whether craniofacial biology is a distinct area of scientific inquiry independent of clinical orthodontics. In his reference to normal science Kuhn (4) introduces the concept of the paradigm which embraces a constellation of beliefs, values and techniques. This provides a conceptual scheme for organizing relevant ideas, observations and forming the basis for theories and hypotheses. Craniofacial skeletal growth up to the mid-twentieth century was primarily descriptive of anatomical form without the interaction of function. The advent of radiographic cephalometrics provided a new dimension to craniometry and anthropometry as longitudinal radiographic studies of the craniofacial complex became a new measuring tool. The orthodontic office became equipped with a cephalostat and cephalometric analysis became available for diagnosis and treatment planning of individual patients. The cephalostat became the new tool for clinicians to analyze craniofacial growth and development and opened up an interest in growth and development and the biologic basis for the study of orthodontics. Meanwhile, the specialty accepted the concept of normal biological variation and the genetic paradigm of Brodie (5) prevailed where craniofacial growth was determined by the age of 3 months and was immutable. This was to be challenged by the functional matrix hypothesis of Moss in the 1960s and 1970s which led to the epigenetic hypothesis by Moss in 1981 and the concept of environmental influences in the form/function interaction (6, 7).

Our understanding of craniofacial growth changed with the introduction of the functional paradigm so clinicians who had previously been constrained by believing that craniofacial growth could not be modified or redirected now had a rational basis for the functional appliance and a new era of appliance therapy was to blossom under the strong influence of

the newly emerging new functional paradigm. To understand postnatal growth of the craniofacial complex was an intellectual challenge for the orthodontist but of direct and practical interest. Modification of craniofacial growth was tested in animal models and extrapolated to the human. Function was a new influence in revisiting the equilibrium theory and the measurement of bite force studies (8) as adaptation to altered morphology was tested and the technical advancements had increased the demand for orthognathic surgery. Adult patients no longer had orthodontic treatment to compensate for their jaw discrepancy but a new era of collaboration between the orthodontist and surgeon was to revolutionize the concept of orthodontic decompensation. This conceptual change provided the surgeon with the ability to optimally correct the skeletal discrepancy without being hindered by the orthodontist having made great efforts to move the incisors into a compromised and compensated position.

As the 21st century emerged so the orthodontist's alliance with craniofacial biology has become distanced. Craniofacial biology aligned with developmental biology and the genomic era emerged with the sequencing of the human genome project. Although gene products may not determine growth they are turned off and on during critical times in development (9). This change in our fundamental biologic premise of trying to understand craniofacial growth and development and how it may affect long-term stability has currently lost its appeal. After all, lifetime retention should solve the problem of worrying whether the teeth are in a stable position. At the molecular level a new vocabulary has evolved and the emerging 'genomic era' needs time to develop and find its relevance to etiology in orthodontics. Contemporary orthodontics is blessed with all treatments in the words of Johnston (10) 'that work well enough to permit a clinician to survive in practice, retire with honor, and die in peace'.

## Evidence-based medicine, dentistry and orthodontics – the emerging 21st century

The premise is that orthodontic treatment is established in a logical sequence during which rational decisions are made that will ultimately determine the process and outcome from the perspective of the patient and the clinician (11). This cascade of events starts with the diagnostic process leading to treatment decisions and options which in contemporary practice has no longer relied on the clinician deciding treatment in a paternalistic or maternalistic role. The patient becomes a partner in the decision making process leading to the informed consent document which identifies the costs, risks and benefits of the proposed treatment plan. The clinician's and the patient's expectations from orthodontic treatment and the attributes which relate to the efficacy, effectiveness and efficiency have emerged (12), as the clinical evaluative sciences in medicine have impacted dentistry and resulted in the development of reliable and valid qualitative and quantitative measures. From the perspective of medicine Sackett (13) wrote ''it is clear that reasonable orthodontists sharply (and sometimes passionately) disagree about the relative efficacy of many orthodontic treatments'. In my opinion, these arguments are being won or lost on the basis of rhetoric rather than science, and the cause for this, to someone of my background, is quite simple: no proper experiments have ever been carried out in orthodontics''.

The 1990s brought a new dimension to orthodontics, as it was recovering from the temporomandibular joint disorder controversy of the 1980s. The need for evidence became important as controversies were supported by strong convictions, weak evidence and questionable theory. This related more to clinician preference and biomechanical techniques than an evidence-based rationale (11). This was recognized by the National Institute of Dental Research who issued a request for applications to evaluate the outcomes and efficacy of different orthodontic treatments. This was ideally to be carried out prospectively with the introduction of the methodological approach of the randomized clinical trial (RCT) into orthodontics. The establishment of a 'gold standard' as the outcome from a RCT was to be considered the highest level of evidence. As the 21st century approached so the results from the RCTs in orthodontics in the USA were being reported to provide the data on which orthodontists could make decisions on one phase vs. two phase which included early orthodontic treatment followed by a second phase of comprehensive orthodontic treatment. However, Johnston (10) makes the argument 'that there are important questions in orthodontics that deal with the modification of signs,

rather than the treatment of disease, that may ***never*** be amenable to ethical investigation by way of the classic RCT'. Thus the 1990s brought concerns expressed by Ahrens (14) that we seem to be living in a decade of disillusionment, disorganization, and dismay.

## Future challenges

Excellence in orthodontics has been associated with the expediency and cost-effectiveness of contemporary high volume orthodontic practices. This concept of clinical practice does not encourage time wasting talking to patients and individualizing archwires but adopting techniques which are simplified, streamlined, and compatible with delegation. This inevitably provides fewer options to individualize treatment for patients as it would cause disruption in the high volume production line.

Perhaps authenticity is pointing our future towards a value system where the focus is to serve our patients and the public with more compassion and sincerity even if it does not necessarily result in an increase in the bottom line of cost-effectiveness in terms of the income revenues. The ability to make sound decisions at all stages in treatment with prior probabilities estimates of the outcomes is the hallmark of expert clinicians. Presenting patients with alternative treatment options with a partnership in decision making rather than the paternalistic 'doctor knows best' authoritative approach provides communication between the provider of care and the consumer/patient. However, this takes clinician time and cannot be delegated to the office manager if the quality of decision making defines treatment options for the greatest benefit to each individual patient and distinguishes the specialist from those who just engage in providing orthodontic care.

When the corporate world faces competition, investment in research and development aims to seek a better product for the consumer. If the specialty of orthodontics is being eroded perhaps it points to our success in simplifying the ways we treat our patients which allows delegation to the non-specialist in the face of increased demand from the public. Distinguishing amongst those who demand treatment, and those who need and would benefit from treatment, has been the prerogative of countries with national health services for these are audited by their governmental sources and agencies.

Those in the academic world of orthodontics are increasingly facing cut backs in higher education. The erosion of full time faculty positions in education are reflected in young orthodontists with high expectations and equally high debts who will inevitably be attracted by options of high income on graduation. If we are to regain the respect and authenticity that each of us require to satisfy our own integrity, the full time academic needs to become a cherished commodity of the profession, as a generation of dedicated teachers reach retirement. The analogy to the fast food era in simplifying the delivery of orthodontics has been established and the best should be maintained. However, as public relations campaigns fail to prevent the erosion of the orthodontic specialty we need to urgently turn our attention to our universities who are in the business of research and development to generate new knowledge. After all academics do not cost much, although they do prefer to work in a '*cordon bleu*' establishment and compete in the *Bocuse d'Or* rather than spending their future overcommitted to being a triple threat as a teacher, researcher, and clinician mass producing a half baked product for expediency. The reduction in the ranks of full time academics erodes the time and effort required for intellectual endeavors associated with research. As this was the initial attraction in competing for a faculty position, so the future of our next generation of academics is in jeopardy. In the words of W.B. Yeats, and quoted by Johnston (15), in the second coming 'Things fall apart; the center cannot hold…The best lack all conviction while the worst are full of passionate intensity' (16).

Lest we be disheartened about the future of our orthodontic profession and its teachers we need to remember that adversity often brings out the best in all of us. Even when financial and moral support for higher education is not forthcoming we will find the resources to maintain the excellence we have sought to achieve over the past century of the oldest specialty in dentistry. Therefore, in the immortal words of Winston Churchill in June 1940 when the future was grim in Britain during World War II 'We shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets…' and as an aside to a colleague 'and we will fight them with the butt end of

broken beer bottles because that's…all we've got' (17). The orthodontic specialty will find a way to overcome, not necessarily in the combative rhetoric of Churchill, but in spite of economic pressures and erosion of our academic numbers the orthodontic profession 'shall never give in'.

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