Self-Ligation in Orthodontics
An evidence-based approach to biomechanics and treatment

Theodore Eliades, DDS, MS
and
Nikolaos Pandis, DDS, MS, Dr Med, PhD, FIMMM, MRSC, MInstP

Forewords by
Lysle E. Johnston, Jr
and
Larry W. White
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Foreword

It may seem strange for a retired academic to comment on a book that in the last analysis deals with brackets and archwires. I disagree. It has been said that all fashion tends to end in excess; the wild, seemingly unprofessional claims surrounding self-ligation and the extent to which they are tolerated constitute a dangerous example. As I see it, events have progressed to a point where the specialty has to take a stand if it is to maintain its status as a learned calling. There is more at stake than market share.

A century ago, the ‘fathers of orthodontics’ accepted – almost as an article of faith – the proposition that the specialty must, of necessity, be grounded in the precepts of science. Over the years, however, we have seen a gradual erosion of our respect for this basic principle. One need look no further than the controversy surrounding ‘evidence-based orthodontics’ to appreciate the extent to which the specialty tends to see ‘science’ as an irrelevant impediment to the orderly flow of commerce. The realization that a practice can be prosecuted more or less in a scientific vacuum has fostered a laissez-faire approach to practice – you do it your way, I’ll do it mine. Everything works well enough to pay the bills; nobody dies from anchorage loss.

Given that there are few accepted standards of practice, many look more to industry rather than to academia for guidance. In the end, however, a company’s fiduciary responsibility is to its stockholders, not to us. Given that the companies supply us with high-quality, salable commodities and underwrite many of the speakers at our meetings and continuing education programs, it is convenient to ignore this probable conflict of interests. It is a Faustian bargain in which the specialty seeks to retain its soul by the simple expedient of adding asterisks to our meeting programs. In the process, we have become inured to the hyperbole of commerce: we are used to being told that a given bracket–archwire combination is more convenient, faster, less painful, etc. Live and let live; however, when the claims go so far beyond the expected degree of exaggeration that they begin to distort the clinical marketplace, clinicians begin to grumble. ‘Somebody ought to do something!’ Unfortunately, we are the ‘someone’. Ultimately, our specialty will be known by our collective response to this challenge.

Historically, orthodontists have been guided by a few core assumptions: expansion won’t hold; lower incisors should be upright over basal bone; in the battle between bone and muscle, muscle will win, etc. In contemporary orthodontics, however, the number of undisputed ‘laws’ has dwindled to perhaps just one: bone doesn’t expand interstitially; it can only remodel on a surface. Accordingly, any claim that a given bracket–archwire can grow bone invokes an effect that not only is assumed to be impossible, but also one for which there is no convincing theoretical basis. We have seen it all before. Some 80 years ago, the Johnson twin-wire was a revelation. Compared to contemporary appliances, twin-wire was almost magic in the way its ligature-less, low-friction brackets, and light archwires could resolve incisor irregularity. Unfortunately, this ‘automatic’ appliance had trouble with extraction and – not unexpectedly – proved unable to grow bone. Although it required no wire-bending and could support a practice, it was incapable of many things that orthodontists thought were important. In those simpler times it didn’t dawn on anyone to claim that the appliance could grow bone or modify the envelope of motion of the lips, cheeks, and tongue. Instead, the specialty moved on to more capable, albeit technically demanding, appliances. In contrast to the Johnson twin-wire, contemporary self-ligating
appliances probably have no inherent technical weaknesses that would preclude their use in the full range of malocclusions, both extraction and non-extraction. In the end, their major weakness seems to be the miasma of unsubstantiated marketing claims that serve to confuse the practitioner and debase the specialty.

If an appliance can’t grow bone, its use by a given office to treat everything ‘non-extraction’ will be a disservice to the protrusive, crowded patient who has been unlucky enough to present there for treatment. Alternatively, if an appliance, against all odds, really can speak the language of the osteoblast and osteoclast, wild claims deflect attention and delay acceptance. Either way, the specialty has reached a critical intellectual juncture. Extraordinary claims require extraordinary proof.

This book is a start.

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No orthodontic development since the advent of the Straight Wire Appliance™ (SWA) in the 1970s has animated and excited the profession quite as much as the re-emergence of self-ligation brackets in these early years of the twenty-first century. The idea of self-ligation brackets has intrigued and fascinated orthodontists since the time of E. Angle, and some of his patented iterations of the edgewise bracket show this preoccupation with simple ligation of the archwire.

Several of Angle’s successors such as McCoy, Boyd, Ford, Russell and others continued the quest for more efficient and uncomplicated methods of ligation. However, a confluence of factors interrupted this pursuit in the late 1930s, e.g. Tweed’s new diagnostic and treatment regimens along with World War II seemed to have erased any general interest in the self-ligation concept, although the snap channel bracket from Rocky Mountain Orthodontics still claimed a few disciples.

Serious efforts to re-establish self-ligation brackets started again in the 1970s with the SPEED bracket developed by Herb Hanson and the Ormco’s Edgelock championed by Jim Wildman. Unfortunately, these two new varieties of self-ligation brackets fell victims to the surge of interest created by the SWA along with some of their own design deficiencies.

Within the past few years, clinicians worldwide have shown some spectacular therapies using the newest self-ligation brackets. But with all of the interest, conferences and investment in this concept, most of the publications regarding the various bracket designs and techniques remain decidedly anecdotal. An embarrassing scarcity of objective literature exists regarding the self-ligation bracket experience and this new publication seeks to remedy the glaring lack of evidence with a fair, non-prejudicial and enlightening consideration of the complete topic. Aside from presenting the fascinating history and evolution of modern self-ligation brackets, the authors, along with esteemed and knowledgeable colleagues, have meticulously examined the common claims of clinicians and manufacturers regarding features of these new brackets such as their efficiency and treatment outcomes, root resorption effects, periodontal consequences, oral microbiota changes and treatment biomechanics.

Lest readers think this volume reduces self-ligation brackets to nothing more than laboratory measurements, graphs and statistics, Drs Eliades and Pandis have also included enough therapies by well known and respected clinicians skilled and experienced with self-ligation brackets to satisfy the most clinically oriented orthodontists. The gap between knowledge by description and knowledge by acquaintance is wide and sometimes seemingly unbridgeable, but these authors have done a masterful job of filling the fissure between research and clinical experience and shown how these two disciplines can reinforce one another and strengthen the commitment to professional excellence.

Clinicians and researchers anxious to review an impartial and comprehensive collection of data regarding self-ligation brackets will find no better source than this new publication devoted solely to the subject. Neither will they discover more disciplined researchers upon whom they can depend for accuracy and integrity than Drs Eliades and Pandis. They have provided the profession with the definitive text on self-ligation brackets, and orthodontists along with their patients will benefit greatly from their efforts.

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Preface

Although the concept of self-ligation was introduced in orthodontics several decades ago, it was only in the last 15 years that these appliances became available in their current form. Marketing of self-ligating brackets has shown a peak during the past few years with every major orthodontic materials manufacturer introducing a self-ligating bracket in the market of either active or passive self-ligating mode.

It may be interesting to view the evolution of the self-ligating concept from the perspective of the Gartner’s hype cycle\(^1\), which was introduced in 1995 to describe the progressive stages of a new technology from its conception to its adoption by the market. This cycle is depicted by a characteristic curve consisting of an initial sharp rise and a subsequent rapid drop, followed by a plateau, and applies to both, emerging technologies, new products or techniques. The cycle progresses through the following stages:

1. ‘Technology trigger’, when the technology is first introduced
2. ‘Peak of inflated expectations’, the first peak after the technology has been introduced without substantiated information
3. ‘Trough of disillusionment’, when the technology does not meet expectations, disappoints, and to a large degree is abandoned
4. ‘Slope of enlightenment’ when even though the technology has been largely abandoned, some individuals still use it and experiment with it in order to understand its benefits
5. ‘Plateau of productivity’ when the benefits of the technology are evident and its performance becomes consistent

A similar hype cycle appears to be occurring in the field of self-ligating appliances; we are probably at the early stages of the cycle, at which products and their benefits are over hyped with limited or no substantiation. This is implied by the fact that the high appeal of self-ligating brackets to clinicians and resultant increased interest of manufacturers was not followed by an analogous clinical substantiation.

With the exception of a handful of retrospective studies on SPEED brackets, for more than 15 years, the sole clinical evidence on the efficiency of these appliances was confined to clinical observations, opinion articles and case reports. Informative as they might be, these sources are often misleading because they are based on a subjective view, and are prone to prejudice in the selection of participants, outcome bias and coincidental correlation. Post hoc ergo propter hoc, i.e. ‘after this, therefore, because of this’, refers to the fallacy of assigning a causal relationship to a variable for an outcome, just because the former happens to chronologically precede the latter\(^2\).

In the absence of appropriate research policies, the presence of conflict between the user–author and the industry may further complicate the extrapolation of conclusions from studies. Recent reports have noted that such a conflict represents a major issue in medical research, with almost 15% of the publications reporting absence of conflict, evidently proven to be associated with the pharmaceutical industry\(^3\). Because the disclosure of interest was not found to be taken seriously by the readers, major biomedical periodicals have adopted a policy which excludes all publications reporting conflict\(^4\). Apart from the abovementioned considerations, classes of publications such as opinion articles and case reports are at the lower level of hierarchy of evidence and can only serve as stimulating factors for further