News & Trends IN ORTHODONTICS

Vol. 16 Oct. 1, 2009

The Creator of Modern Orthodontics Dr. Larry White A Biographical Portrait of Edward Hartley Angle Dr. Sheldon Peck Evidence-Based Damon System (Part II) Dr. John Lin ABO Case Report : Molar Scissors-bite Correction Dr. W. Eugene Roberts

From left to right: Dr. Bill Su, Dr. Jerry Watanabe, Dr. Chris Chang, Dr. Larry White at the 2009 Damon Forum in Phoenix

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熱愛學矯正

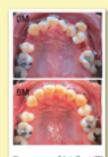


張慧男 博士



學會開始做矯正需多久?

39小時讓您入門矯正。本課程採高效學習法及高效矯正簡報法-Keynote,在舒適、輕鬆的環境下,學會簡單有效的矯正方法,教室與診間結合,讓您現學現用,立即熟悉各種習得的技巧,而不需太多課後複習。全程以 In-Office Training 方式,用病例帶動分析、診斷,治療計畫與療程技巧,每一步單皆以圖片及影片教學,讓您很難錯失任何環節,更沒有聽不清楚或無法理解的可能。為提高課後自我學習及臨床印證之效率,另備有教學電子檔,供學員家中研習。我們的終極目標是:用最短時間、最輕鬆的方式,讓每位學員-<u>熱愛嬌正學、熱愛學矯正</u>。



Damon + .014 Cu NiTi

新竹貝多芬齒顎矯正中心負責人 美國印地安那普渡大學齒顎矯正研究所博士 美國齒顎矯正專科醫師學院院士(ABO)

矯正植體課程

矯正植體的操作時機、植法
 與實習、個案討論、臨床跟

新竹(五) 12/18/09

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診及實作示範。

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1	2010 課程預告		Damon矯正課程				
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	05/25/10	04/29/10	1	09/13/09	09/17/09	理想入門病例 + Damon 黏著	Bonding (D3MX) + BT
	06/01	05/13	2	09/27	09/24	快速矯正療程四部曲	Ceph + Photo
	06/15	05/27	3	11/01	10/15	簡捷有效的貓定系統	Damon + OrthoBoneScrew I
	06/29	06/03	4	11/15	10/22	不拔牙與拔牙分析	Damon + OrthoBoneScrew II
	07/06	06/24	5	11/22	10/29	Damon 診斷流程及微調	Finish Bending
	07/20	07/08	6	12/06	11/26	完工檢測及報告示範	Fixed Retainer (FR)
	07/27	07/15	7	12/20	12/03	維持及復發;病例示範	Presentation Demo
	08/10	07/22	8	12/27	12/10	矯正力學及診斷分析(1)	DDX + Case Reports I
	08/24	08/12	9	01/10/10	12/31	軟硬組織及診斷分析 (2)	DDX + Case Reports II
	08/31	08/19	10	01/17	01/07/10	兒童矯正及診斷分析 (3)	DDX + Case Reports II
	09/07	09/02	11	01/24	01/21	成人矯正及診斷分析 (4)	DDX + Case Reports IV

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International workshop

 Keynote & managment OrthoBoneScrew & Damon

10/19~21/09

助理訓練課程	
每梯次共雨堂課程與技術操	
年,內含照相技術、Morph	
與公開衛教之電腦資料處理	

 : 另安排一次診所見習・ 新竹(五)
 10/23 、 30/09'

課程項目	BBED	上課地點
Domonitri	台北/台中/高雄	[台北]
CONTROL PRESS	【課程】09:00-12:00	恒速資訊中心畢卡索廳
	【實習】另外安排	/台北市復興北路99號12F
		(捷還南京東路站旁)
矯正進階	【新竹】09:00-12:00	【新竹】
	【高雄】14:00-17:00	金牛頓藝術科技公司
		/新竹市建中一路25號2F
矯正精修	【課程】09:00-12:00	【台中】
		文化大學台中教育推廣部
矯正植體	【課程】09:00-12:00	/台中市西屯區中港路二段128
(論中・映観)	【實習】13:30-20:00	之2號3樓
		[高雄]
助理訓練班	【課程】10:00-14:30	科學工藝博物館S107教室
(倉中・暁餐)	【實習】15:00-20:00	/高雄市三民區九如一路720號

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	新竹 (二)	高雄 (四)	Paper reviews	Topics & Case Demo
1	09/15/09	09/17/09	Bracket placement & workshop	Crowding: Ext. vs. Non-ext.
2	10/06	10/15	Impacted canines	(U) Impacted Teeth: Ant. vs. Post.
3	10/27	10/29	Canine Substitution	(L) Impacted Teeth: Ant. vs. Post.
4	11/24	11/26	Anterior Esthetics	Missing: Ant. vs. Post.
5	12/01	12/03	Excellence in Finishing (occlusion)	Crossbite: Ant. vs. Post.
6	12/29	12/31	Excellence in Finishing (esthetics & perio)	Deep Bile vs. Open Bile
7	01/19/10	01/21/10	Ortho-Perlo-Restore connection	Low vs. High Angle & Gummy Smile
8	04/06	04/08	Adjunct to perio	Root Resorption & Relapse
9	04/20	04/22	Unhappy patient	Perío-Ortho
10	05/04	05/06	DI & CRE Workshop (1)	Implant-Ortho
-11	05/18	05/20	DI & CRE Workshop (2)	IDT
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 (協助毎位學員了解由古典到現代之文献・進面應用於實 際病例:並藉由DI及CRE讓精緻兜工(Excellent Finishing) 愛成易達到的目標。

 新竹(二) 11/03/07 12/15 01/12/07 02/09 03/09 04/13/07 05/11 06/22 07/13 08/17 09/14 10/12 11/16 12/14

Journeys that turned into legends

When I started my orthodontic training 23 years ago, there were many systems in Taiwan, namely, Tweed, Segmental arch, Straight wire, Multiple loop light wire, and functional appliances. How could a young man learn so many different systems with limited time and financial support? So I thought it was a good idea to go back to the origin when people find themselves lost in all kinds of choices. It was only logical that I began to take a closer look at the history of Orthodontics for guidance. History studies soon became my passion and continue to be an integral part of my life.

Recently, I had the privilege to meet with two orthodontic giants, Dr. Larry White and Dr. Sheldon Peck. They both excel at orthodontic history. It was amazing to hear their presentations about Dr. Edward H. Angle, the creator of modern Orthodontics. I was not only deeply impressed by their rich knowledge on the subject but also their presentation styles. To my surprise, they both used Apple's Keynote presentation software in a very sophisticated way. After their speeches, I went to express my appreciation for their insightful talks and a desire to share their research with our NTO readers. After months of communication, I am delighted to report that in this issue we have four features on the legendary life of Dr. Edward H. Angle, thanks to the gracious contributions of Dr. Larry White and Dr. Sheldon Peck and the generous permission from the Angle Orthodontist. I believe these four articles are by far the best research summaries about Dr. Angle.

History is important. We learn so much from history. However, when we extrapolate something earlier, we should be very careful to evaluate them by their time, not ours. The story of Dr. Angle is like the gravitational force that pulls the orthodontic events all together. Hence, it is an imperative for every orthodontist to get familiar with the life journeys of Dr. Angle and how he had refined our profession in term of his concepts and spirit of learning and teaching. We are lucky to have Dr. Angle to be our profession's founding father. He is undoubtedly our greatest asset. Dr. Angle remaining to be the most influential figure in Orthodontics, against the past 100 years of testing and challenging, believe me, is not merely a matter of chance or seniority. Read these four articles and be enlightened.

Chris HN Chang, DDS, PhD, Publisher

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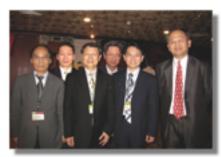
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Consultant Dr. W. Eugene Roberts

Contributors (from left to right): Dr. Hong Po Chang, Consultant Dr. Ming Guey Tseng, Consultant Dr. John Lin, Consultant Dr. Frank Chang, Consultant Dr. Johnny Liao, Consultant Dr. Chris Chang, Publisher



Consultant Dr. Larry White





Consultant Dr. Frederick J. Regennitter

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Guest Editor Dr. Rungsi Thavarungkul

Edward Hartley Angle (1855 - 1930) The Creator of Modern Orthodontics



True to the manner of 19th century professionals, no one ever saw Edward Hartley Angle smile in a photograph. Smiling would symbolize frivolity and shallowness, which no professional ever wanted to project. Thus, before the camera Angle always wore what sport columnists now call his "game face." (Figure 1). From those photos one could easily gather the impression that Angle had no sense of humor, but they would be wrong. Home movies exist that show him joking, laughing and humorously posing for the benefit of friends. Nevertheless, Angle did have a seriousness about orthodontics that transcended all other interests in his life, and he gave himself fully to it.

Figure 1: Edward Hartley Angle in his latter years.

Early in life he demonstrated an inventive, visionary personality that lifted him away from the daily chores of his father's 200 acre Pennsylvania farm and dairy operation; so much so that he continually perplexed his father with his inventions and carvings. He confided in his wife that he had little hope for "Hart" because he didn't seem to enjoy working and would probably tinker his brain away Fortunately, EHA's mother nurtured his inventiveness and in his adolescence apprenticed him to a local dentist. Angle's personality quickly adapted and fitted with dentistry, and he soon felt that he had found a vocation that agreed with him. After finishing high school he entered dental school at the Pennsylvania College of Dental Surgery.

At the time, the orthodontic curriculum was a neglected part of the prosthetic division. Orthodontists needed to borrow from other disciplines any of the materials and instruments they needed; e.g., piano wires, springs from clocks and watches, etc. Orthodontic therapy required more adaptations on the part of clinicians than most wanted to make.

After graduation from dental college, Angle began a general practice in Towanda, Pennsylvania where he contracted tuberculosis. This made him decide that a higher climate with out-of-doors work would resuscitate his health, and he moved to Montana and established a sheep ranch in 1879. The famously cold winter of 1882 wiped out his entire herd of sheep and left him penniless.

The Montana climate did rescue his health, and after his economic debacle there he returned to dentistry and joined the faculty at the University of Minnesota Dental College. This move marks an important pivot for his personal and professional life. While in Minnesota, he began to work seriously on orthodontic materials and techniques, and in 1893 he met Anna Hopkins, who served as his secretary. Anna came from a farming family and showed her high intelligence and common sense early in life as she began to teach school at 14 years of age. She later attended secretarial school in Minneapolis and went to work at the University of Minnesota.

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Anna became Angle's confidant, muse, lover and eventually his wife and professional colleague (Figure 2). She was as composed as he was mecurial. She displayed tolerance to his intolerance and edited the tirades he addressed to enemies and friends alike in the 30 - 40 letters he dictated to Anna each day. In short, she provided the balance to his life that he would not have otherwise had. No one had considered Angle very bright intellectually as he grew up. He was naturally left-handed, but in the custom of the day that would persist until the 1950s in the United States, teachers insisted that left-handers become right-handed. Though this partially accounts for some of his academic difficulties, it also helped him develop an ambidexterity that served him well in dentistry and with the illustrations that he completed for his articles and books.

Anna, encouraged by Angle, eventually received her dental degree from the University of Iowa Dental College in 1902 and became one of his orthodontic students. With these achievements she transitioned into a full-fledged colleague along with her amanuensistic duties.

Angle convinced himself over the years that orthodontics or orthodontia as people referred to it in those days needed a separate curriculum from dentistry, and he advocated such a change in unmistakable terms at the 9th International Medical Conference held in Washington, D.C., he gave his first orthodontic presentation where he shared his thoughts on the orthodontic program of study. The audience dismissed it, and this first experience in corporate participation left him tremendously disappointed.

However, the paper he delivered and the audience rejected served as the basis of his first book, System of Malocclusion. Angle commissioned the Wilmington Manufacturing Co. of Philadelphia, Pennsylvania to publish his book and also contracted with them to manufacturer and distribute the various instruments and materials he continually designed for orthodontists

From Minnesota he moved to Northwestern University in 1892, and it didn't take long for the headstrong orthodontist to have conflict with the administration and students who apparently took exception to his autocratic and demanding manner. He left after three years and moved to St. Louis, Missouri, where he attended medical college and gathered a M.D. degree. While in St. Louis, he taught at Dental Department of Marion-Sims College of Medicine, but again he found frustration within the academic community and left to develop his own Angle School of Orthodontia in 1896. Anna assisted him in this enterprise, and soon his skill and knowledge became widely appreciated and dentists from all over the world enrolled in his courses. One of the restrictions he placed on those who enrolled in his courses was the prohibition of graduates to remain in St. Louis to practice.

In 1895, Angle found a new distributor and publisher for his publications and orthodontic materials in S.S. White, also of Philadelphia, Pennsylvania. He had developed a company called the Angle Regulating Company. A manufacturer in Chicago, Illinois would construct appliances and send them to Angle, who would inspect them carefully before sending them on to S.S. White for distribution. He charged the company 55% of list price, which allowed them to make 45% on any sales they made. Needless to say, Angle grew wealthy through this arrangement. He had designed and developed the E arch mechanism and by 1905 had moved onto the ribbon arch, which served him until 1924 when he finally introduced the edgewise bracket. He published an article in Dental Cosmos entitled The Latest and Best in Orthodontic Mechanism, which described the use of the new bracket.



Figure 2: Drs. E. H. Angle and Anna Hopkins Angle in their latter years in Pasadena, California.



In 1900, Angle was only one of the two or three dentists in the world who practiced orthodontics exclusively; but by 1907 sixty people had restricted their practice to only orthodontics, mainly due to Angle's influence. By 1900 enough orthodontists existed that they decided to form the American Society of Orthodontists, which was the precursor to the American Association of Orthodontists. Angle was instrumental in its formation and remained a member until a colleague from Great Britain, Dr. Herbert Visick, challenged him by asking a number of questions, which irritated him enough to ask the ASO to dispel the annoying doctor. When the ASO ruled against Angle, he left the society along with several of his disciples and never returned.

Angle moved to New York City where he continued to teach courses and soon found what he considered the

Figure 4 : Angle School of Orthodontia Faculty. Angle, Pasadena; Grunberg, Berlin; Noyes, Chicago; Oppenheim, Vienna.

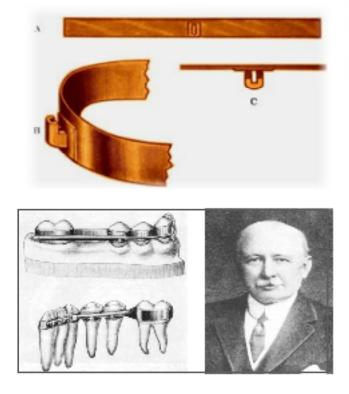


Figure 3: Angle School of Orthodontia, Pasadena, CA. (1922)

perfect setting for his school in New London, Connecticut. He finally closed this school in 1911 to retire in Pasadena, California. He intended to lead a leisurely life in retirement and did until dentists came to him and proposed to have an Angle School of Orthodontia (Figures 3 and 4), which they financed and chartered through the State of California. The school opened in 1923 and closed abruptly in 1927. Angle's health had begun to deteriorate, but the deciding factor to quit apparently was the development of a new bracket by one of his favorite students, Dr. Spencer Atkinson. Atkinson had simply taken the old ribbon arch bracket made a few changes and cut an edgewise slot in the face of the attachment (Figures 5 and 6). Angle took such exception to this effrontery by a trusted (read sycophant) colleague that he left the school immediately. The students remaining at the school, among whom was Charles Tweed, received the rest of their orthodontic education from George Hahn, an Angle advocate and assistant



Figure 5: Ribbon Arch Bracket. (1916)

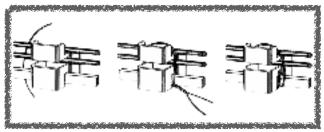


Figure 6: Atkinson's Universal Bracket.

Figure 7: Dr. Calvin Suveril Case and one of his early appliances.

Angle had a touchy personality that did not suffer insults, challenges or even differences of opinion graciously. The most contentious professional dispute he had was with Dr. Calvin Case of Chicago, Illinois regarding the extraction of teeth for orthodontic patients (Figure 7). At one time Angle had advocated the extraction of teeth, and, in fact, had removed teeth in the treatment of Anna Hopkins. However, with the ribbon arch bracket he then used, he could not parallel the roots of the teeth on either side of the extraction space. Case, on the other hand advocated removing teeth only after a careful diagnosis and treatment plan. Angle had not discovered the auxiliary springs that Raymond Begg of Australia later developed to solve the problem of root control. This failure resulted in his adamant posture that teeth should not be removed to solve malocclusions. The animosity with Case escalated to the point that Angle refused to recognize Case's discovery and use of elastic forces in orthodontics and always referred to them as Baker anchorage.

Angle died in Aug 11, 1930 in Santa Monica, California in an apartment he and Anna had taken to be near the ocean. He had continued to work on iterations of the edgewise bracket (Figure 8), and the night he died he told Anna that he could not improve the design and had finished with the "newest and best."

Angle had a complicated personality - petulant, petty, hubristic in a way that made him impervious to others ideas and deprecating. He was often cruel to colleagues, but in many ways he had a genius for design and mechanical solutions for the problems that faced the profession. He demanded much from his students - some say too much, e.g., the time he told Cecil Steiner that he was hopeless and would never become an orthodontist. Anna Hopkins Angle told Cecil to disregard what her husband said and to keep on working. She thought he had the makings of a great orthodontist, and, of course, he did. Anna frequently had to intervene to mitigate the vitriol Edward often discharged.

No one can deny the great and positive influence of Edward H. Angle. His clear and simple classification system along with the edgewise bracket have both endured for over a century - no mean achievement in any scientific discipline. But perhaps his greatest triumph was in the establishment of orthodontics as the first specialty of dentistry even though he didn't intend for orthodontics to remain as a part of dentistry. His students went on to form the nucleus of leaders in the profession not just in the United States but throughout the world, and his unswerving commitment to excellence will continue to serve as an enduring legacy for all orthodontists.

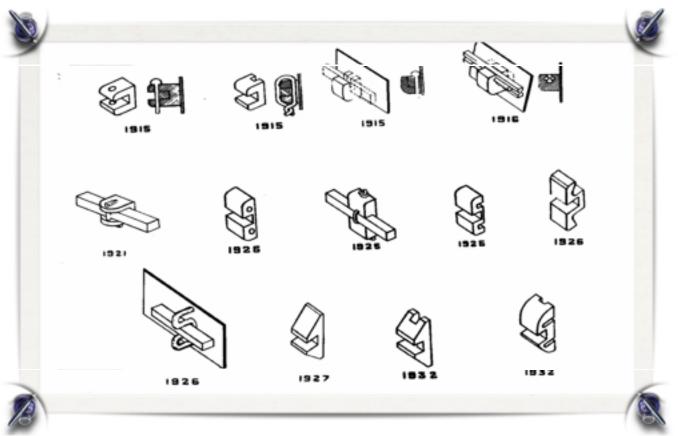


Figure 8: Some of Angle's patented iterations of the edgewise bracket.

Special Article

A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 1

Sheldon Peck^a

ABSTRACT

Much of what is known about Edward Hartley Angle, MD, DDS (1855–1930), the acknowledged "father" of modern orthodontics, has been derived from secondary sources, accounts written by his contemporaries and others. New historical research using primary sources, largely the recently published four-volume sourcebook of Angle's correspondence and business transactions from 1899 to 1910, gives a broad view of the personality, interests, and activities of this prime mover in the evolution of orthodontics. This three-part article highlights aspects of Edward H. Angle's life and persona, based on new findings culled from his letters and other personal documents. Part 3 presents a biographical chronology of Angle's remarkable life. (*Angle Orthod.* 2009;79: 1021–1027.)

"To arrive at a just estimate of a renowned man's character one must judge it by the standards of his time, not ours."

Mark Twain, Personal Recollections of Joan of Arc, 1896.

PART I

Old letters often tell rich history. At certain junctures in the historical record, details found in the letters of visionary leaders reveal important developments better than a simple recounting of events can. Orthodontics 100 years ago was at just such a critical point. No personality central to the history of orthodontics stimulated as much progress, excitement, and polarity as Edward Hartley Angle, MD, DDS (1855–1930), the acknowledged founder of this clinical specialty. Early in the 20th century, he dominated the emergence of "orthodontia as a science and a specialty." This inventive doctor gave malocclusion the primacy and order it needed. He also created the first educational program

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Accepted: February 2009. Submitted: February 2009. © 2009 by The EH Angle Education and Research Foundation, Inc. to train specialists in orthodontics, and he developed the first prefabricated orthodontic appliance system. Thus, the exquisite series of letters, accounts, and patents from the mind and hand of Edward H. Angle, now contained in the Angle Archives and published in 2007 in a four-volume sourcebook, give new life and context to the early history of orthodontics.

Dr Angle's papers, like the literary remains of other great pioneers, provide clear windows into the writer's remarkable nature, capacities, and limitations, as well as a rich historical panorama of events and relationships during the seminal days of modern orthodontics. The published archives include Angle's correspondence and business papers written between May 3, 1899 and December 19, 1910. It was a time of Angle's most provocative accomplishments and most accelerating prosperity. The bulk of this period includes 9 of Angle's 13 years (1895 to 1908) spent in St Louis, golden years in Angle's professional development and in the history of that city.

In the early 1900s, St Louis, Missouri, was undergoing a renewal in celebration of its role as the gateway to western expansion of the United States. The centerpiece for its renaissance was the Louisiana Purchase Exposition, better known as the 1904 World's Fair of St Louis, a 7-month extravaganza attracting nearly 20 million visitors. It was a dazzling show, built in 1200-acre Forest Park, featuring colossal outdoor neoclassical sculptures, and pavilions designed as Grecian palaces filled with futuristic technologies and other displays of science, art, and optimism. St Louis was thrust into a global spotlight. So were Dr Edward Angle and orthodontics.

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PECK

This was the time, at the turn of the 20th century, that Angle implemented his new school and sought the recognition of orthodontia as a full and independent branch of dentistry. By 1904, the Angle School of Orthodontia was training two classes a year, with many students coming from distant places to learn from the "world's greatest" clinical orthodontist. During the 1904 World's Fair, St Louis was the host city for the Fourth International Dental Congress, attended by many foreign dignitaries. Angle chaired the Congress's highly successful section on "Orthodontia," and in the process, he engaged many who became new friends and followers.

1022

To appreciate Angle's times best, we should apply a bit of retrospective context. In 1904-near the temporal midpoint of the Angle Archives-America and Americans were very different than they are today. It would still be another decade before the dawn of personal income taxes. The average life span in the United States was 49 years in 1904. The leading causes of death were respiratory infections: pneumonia, influenza, and tuberculosis. Only 14% of homes had a bathtub; only 8% had a telephone. A 3-minute call from St Louis to New York City cost \$8, which is equivalent to \$176 in today's dollars; Angle's round-trip train ride to New York cost \$25 (\$550 in current money). The average worker's wage was 22 cents per hour, producing a yearly income between \$300 and \$600. Competent professionals (including dentists) could expect to earn \$2000 to \$4000 per year. Angle boasted that one of his former students practicing orthodontics in New York City was earning \$40,000 annually, an extraordinary income in those days.3:302

Further context may be gained with some knowledge of Edward Angle's 44 years of life before the 1899 start of the remarkable record of his letters and accounts contained in the Angle Archives. Thus, the aim of this three-part article is to provide readers with a biographical portrait of Dr Angle, the man, the writer, the inventor and the professional, incorporating a sketch of his early life and some happenings, insights, and impressions culled from his own words within the precious collection of Angliana, which has been recently published. Part 3 is a chronology of Angle's life with new findings from recent historical research.

THE EARLY YEARS

Edward H. Angle's early years reflect elements of a classic American success story of his era: a fiercely determined young man of no remarkable heritage serendipitously finding his considerable aptitudes and blazing trails in pursuit of his visionary goals. At various times in his letters, he expressed his admiration for a pantheon of archetypes with traits akin to his



Figure 1. Edward H. Angle's boyhood home on his parents' farm in District 1, "Ballibay," Herrick Township, Bradford County, Pennsylvania. This farmhouse is still in use, although no longer in the Angle family. The last member of the family to occupy the farmhouse was Neal Angle, Dr Angle's nephew, who sold the farm in 1946. (Early 1900s photograph, reproduced from the 1938 meeting program of the Angle Society.)

own, such as the indomitable messenger in "A Message to Garcia," the popular, inspirational short story (1899) by Elbert Hubbard, which became required reading for Angle's students.^{1:84,151} Samuel L. Clemens (Mark Twain),^{2:503} poet-storyteller James Whitcomb Riley,^{1:564} George Catlin,^{1:608} Benjamin Franklin, and Rembrandt van Rijn were among his favorite heroes. All were creative achievers and resolute individualists of humble birth and with great connection to everyday people.

Dr Angle never forgot his farm-boy life in northeastern Pennsylvania that helped shape many of his qualities and guirks in adulthood. From the southern boundary of District no. 1 of Herrick Township in Bradford County, you could almost see the deep, winding chasm of the Susquehanna River valley. This area was nicknamed "Ballibay" in the 1820s by the new settlers from the town of Ballybay, County Monaghan, Ireland. Edward Hartley Angle was born here June 1, 1855 in a modest, white wood-framed house near the crest of a hill on his father's 200-acre dairy farm (Figure 1). He is recorded in the 1860 Bradford County census book as "Hartly," the fifth of six children, and third son, to Philip Casebeer Angle and Isabel Erskine Angle. His father's roots were primarily Dutch and his mother was born in Ireland. From childhood, he was called "Hart" by his family and close friends. The Angles had a seventh child, William, a bright lad, who died of illness at age 11. Teen-aged Hart was hurt terribly by the loss of his younger brother Willie, his favorite sibling.1:107-108

Hart showed no enthusiasm in school or on the farm, to the utter dismay of his unsympathetic father. He was always behind in his learning, especially math, and he avoided farm work as much as he could. He was a natural tinkerer, a whittler, a maker of things. In reminiscences, his wife Anna told about his heavily scarred knees, lifetime reminders of boyhood knife

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slips. When his father needed a more efficient hay rake, 11-year-old Hart invented one. However, he did not get much appreciation for the new machine, and soon someone else applied for and was awarded the patent for Hart's instinctively clever work. It was an early lesson in life's unfairness that the sensitive boy probably long remembered.

In Angle's letters, we find a man who cherished his boyhood friendships throughout life. He never lost contact with some of his Herrick chums, like Cyrus Camp, Guy Fuller, and Jerry Sanger. His correspondence with them is often in the playful tones of a kid still horsing around the farmyard.1:187;2:398,502 Angle peppered his letters to his hometown friends with monikers concocted from the names of town fathers with whom the boys occasionally skirted trouble. "Cy" Camp was sometimes referred to as "J. Rufus Avery" or "Gideon Squares" in Hart's jocular letters to him.1:187,240-242 Angle also showed his self-deprecating humor to old, dear friends in the variety of comical aliases he used in signing his letters: Alexander J. Horatio, 1:523-525 Alonzo Revellen,1:201-202 Big Foot,3:261-262 Colossus Doc the Great,2:622-623 Flat-nosed Hart,3:279-280 Little Harty Angle,1:819-820 Old Man Friar,1:53-54 Uncle Reuben,2:622-623 and sometimes simply the geometric notation "Z."^{2:381–382}

In 1874, at age 18, he was introduced to dentistry with coaxing from his understanding mother Isabel. Recognizing his nascent mechanical skills, she secured a position for Hart with a dentist in nearby Herrick, as an office apprentice. He got on well in dentistry-it appealed instantly to his keen manual and visual senses, his love of tools and his need for orderliness. Two years later, he applied to dental colleges. His scratchy, brief letter of inquiry dated September 6, 1876, to the Baltimore Dental College is the earliest document extant from his hand. In it, he touted his proficiencies in the indispensable texts of the day: Harris's The Principles and Practice of Dental Surgery (1863) and Piggot's Chemistry and Metallurgy, as Applied to the Study and Practice of Dental Surgery (1854). Although his English constructions and spelling were rather crude for a schooled 21-year-old, young Angle exuded the restless confidence that would mark his entire adult life and would win him success in many adventures to come. He was invited to enroll at Pennsylvania College of Dental Surgery in Philadelphia for their DDS program, then arranged in two 6-month terms spaced over a nominal 2 years and located in a building at the northwest corner of Twelfth and Filbert Streets. Angle alluded to his college experiences years later in friendly letters with classmates E. L. Townsend^{2:622} and Charles J. Tibbets.^{2:623}

THE YOUNG DENTIST

After dental school graduation in 1878, Edward Angle went to the Bradford County seat, Towanda, and set up a general practice of mechanical dentistry in the center of town. He became a boarder in the home of Towanda's leading physician, Dr David Shepard Pratt, a good strategic decision for the bright new dentist in town. Young Dr Angle advertised in local newspapers, such as *The Sullivan Review*, and appeared to be rapidly successful. Here in his leisure as an unmarried young professional, Angle developed his first interests in mechanisms for tooth alignment or "regulation," considered the main purpose for moving teeth at that time.

In Towanda, Angle experienced declining health that was to plague him on and off for the rest of his life. He was diagnosed with pleural pneumonia. Today, we may understand this chronic respiratory condition as a consequence of tuberculosis. One popular treatment of the day was for the sufferer to move to fresher, cleaner air—to a pristine resort set up for this purpose or to the mountains or the desert. Angle formed special bonds throughout his career with those who shared the same affliction, former student Albert "Leaf" Ketcham being the most prominent among them.^{2:107-108}

After 3 years of dental practice in Towanda, in the spring of 1881, 26-year-old Dr Angle abandoned dentistry and took a train to Minneapolis, Minnesota, on a physician's advice, in search of better health. Within a few months, his condition improved and, with his recovery, came renewed confidence and resolve to make something of himself. For his health's sake, Angle was considering permanent retirement from dentistry in favor of work that was less confining and more outdoors. In Minneapolis, he heard that sheep farming in Montana was where the "big money" could be made. In the fall, he returned briefly to Pennsylvania to entice some of his old farm buddies from Herrick to join him in setting up a lucrative sheep-raising business. They signed on excitedly, and the lot of his Ballibay cronies-including his older brother Mahlon and close friend Cy Camp—traveled with the freewheeling Hart to the fresh air of the Montana wilderness in search of their "pot of gold" (Figure 2).

Angle invested all his savings into their sheep-farming venture, all to be undone by the great blizzard of 1882, a record-breaking deep freeze that killed off the entire herd. The empty-handed boys from Ballibay sullenly returned to Pennsylvania, except for Hart. A defeated Angle, feeling physically better but mentally depleted, hobbled in to Minneapolis by mid-1882 looking for work—again in dentistry.

He got back into general dental practice and soon

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Figure 2. Studio photograph taken in Minneapolis, Minnesota, of young "Hart" Angle in hunting uniform with an English Springer Spaniel at his side, around the time of his Montana sheep-farming adventures, c. 1881–1883 (26–28 years old).

resumed the creative thinking and tinkering with toothregulating appliances that he began in Towanda. Within a couple of years, Angle inquired at the Dental Department of the Minnesota Hospital College in Minneapolis regarding faculty employment. Impressed with what he had to offer, the college administrators tailored a position to suit his skills and their needs. In 1886, 31-year-old Edward Angle was appointed a professor of histology and lecturer on comparative anatomy and orthodontia. A few years later, after the Hospital College merged into the University of Minnesota, he was elevated to professor of orthodontia, a rare position in those days when orthodontia was a neglected part of the prosthetics department at dental colleges. At the same time, he quickly ascended through the ranks to become president of the Minneapolis City Dental Society in 1888. He also was able to maintain his small private dental office, where he experimented more and more with novel approaches in orthodontic mechanisms. In sum, through his resilience, industriousness, and good fortune, Angle seemed to have landed on his feet psychologically and financially from the Montana get-rich-quick debacle a few years earlier.

His big break came in 1887 when Angle was permitted on the speaking program of the Ninth International Medical Congress convened in Washington, DC. On the fourth day of this important Congress, Thursday, September 8, 1887, the section on "Dental and Oral Surgery" was called to order at 11 AM in the Universalist Church at the corner of 13th and L Streets. Thirty-two-year-old Dr Angle was the youngest of the session's speakers and was scheduled last on the day's program. Two prominent authorities on orthodontics directly preceded Angle: Clark Goddard, professor at University of California, San Francisco, and Eugene Talbot, textbook writer and professor from Chicago.

A confident Edward Angle presented his talk, entitled "Notes on Orthodontia with a New System of Regulation and Retention," using lantern slides-a relatively new visual aid for lecturing. He demonstrated his classification of tooth movements and his novel orthodontic devices, such as piano wire in a soldered "pipe" (tube) and the jackscrew and traction screw. The open discussion that followed was sometimes acrimonious. Many well-known dentists in the audience, including John N. Farrar and Victor H. Jackson, accused Angle of falsely claiming originality. They cited others (including themselves) who earlier introduced similar appliances. Angle carefully explained how his devices were different and better, indeed "new," but apparently, he did not prevail. The edited paper and subsequent inflammatory discussions were published in the Transactions of the Ninth International Medical Congress under an imposed, truncated, noncontroversial title, "Notes on Orthodontia." This 1887 article commonly has been called the "First Edition" of his classic textbook on the treatment of malocclusion. Actually, Angle considered that his first edition was his 14-page chapter appended to Loomis P. Haskell's new book on dental laboratory procedures published in 1887; he titled this version of his Congress paper "Extracts of Notes on Orthodontia, with a New System by [sic] Regulation and Retention" and it did not contain the discrediting commentaries.

Years later, colleagues observed that the bitterness Angle developed from the contemptuous treatment he received at this 1887 Congress helped harden him for the professional "fights" he was to invite and encounter throughout his adventurous career. To those who would challenge him, his style often seemed abrasive, sometimes brutal; to others, those loyal to him and backing his causes, he was as charming and gentle as a puppy.

THE FIRST SPECIALIST IN ORTHODONTICS

The year 1892 was a watershed in Angle's professional development: he announced that he would be practicing orthodontia to the exclusion of all other dental therapies. With this decision, he became the first

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acknowledged exclusive specialist in orthodontics in the world. Until this moment, none of the authorities on orthodontics worldwide and in history ever mustered the vision and confidence to limit their dental or medical practice to only this emerging type of treatment. Angle was no longer on the faculty at the University of Minnesota. He resigned to concentrate his energies on experimentation in orthodontia and the development of marketable, prefabricated ("readymade" in his vernacular), new treatment appliances. He also needed time to work on his textbook's third edition, his first real book, a 51-page work, 20 pages longer than his 1890 edition, which had been published as an appendix in the second edition of Haskell's prosthetics laboratory book. He hired Anna Hopkins, a bright young Minneapolis secretarial school graduate, to help him with his book and practice. It was the beginning of a life-shaping relationship for both of them.

Also by 1892, Edward Angle was beginning to feel stress from his troubled marriage. Florence A. Canning was the sister of John E. Canning, a Minneapolis machinist whom Angle came to know and rely on, the way any inventor needs a toolmaker. It seems that Angle met Florence socially through this business relation. In March 1887, 22-year-old Florence and the 31-year-old dentist married. Less than 9 months later their daughter Florence Isabel Angle was born in Minneapolis, only 3 months after her father's disastrous appearance at the Ninth International Medical Congress in Washington.

Angle's correspondence a dozen years later described a disintegration of this marriage from the start. The couple was grossly mismatched, he the ambitious idea man and she the daydreaming reader of romances.^{2:187–188} Angle gradually lost respect for Florence "Senior," as he referred to his wife in some letters, and he became by default an absentee father to their sickly daughter "Florencie." By July 1900, his personal confidence in his new directions was strong enough to prompt him to move out of their boarding-house apartment in St Louis.^{1:805;2:186} He had his thriving practice, his income-producing books, patents and appliances, his growing international fame, his prospering proprietary school, and perhaps most significantly, Anna Hopkins, his secretary, amanuensis, confidante, and sympathetic soul mate (Figure 3). We can follow his travails as a distant father in his stream of letters trying to influence the upbringing of his daughter to whom he wrote as "your ol' Padre"* (Figure 4). It took Angle another 9 years to deliver an acceptable divorce settlement for Florence Senior in May 1908.3:305 Angle's mother had died a few months earlier, and the delay

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Figure 3. Edward Hartley Angle, age 43 years, 1898, St Louis, Missouri, at the beginning of his legendary ascent in international fame and fortune.

and particular timing of his divorce may well reflect the determination of a devoted son to shield his devout mother from the shame of his broken marriage. On June 28, 1908, Hart and Anna were married in St Louis (at ages 53 and 36, respectively) and within 2 months the newlyweds had moved to New York to begin a new chapter in their lives, as retired gentry.^{3:305}

Contemporaneous observers and commentators agreed that Edward H. Angle-whether they liked the man or not-was a pillar of integrity and a model of character, presumably built up from the high values drilled in at home during his childhood. But, he was not without personal faults, some related to his uncontrollable need to defend his honor when he perceived an attack. One of Angle's more blatant weaknesses was his relapse occasionally into verbal abuse, an outspokenness commonplace among the educated and privileged of his time. It was a more benign prejudice than the hardcore racial and religious bigotry that was virulently expressed in society later in the 20th century. At various times in his letters, he disparaged the Irish, Scots, Jews, Christian Scientists, blacks, Easterners, university professors, drunks, women, and "quack" colleagues, to name a few easily labeled groups. He

^{*} References 1:474, 574-575, 795-796; 2:106-107.

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Figure 4. Only known photograph of Dr Angle's daughter, Florence Isabel Angle (on left), seen with him and an unidentified woman at his 65th birthday party, June 1, 1920, held in the garden at the Angles' home in Pasadena, California. Aged 32 years at the time, she was a schoolteacher in Los Angeles. Never married, Florence died in Morganton, NC 50 years later. (From the Milo Hellman collection in the Angle Society Archives.)

would trot out any stereotypical device he could recall to belittle someone who had caused him embarrassment or financial jeopardy. Angle was particularly callous about people whom he perceived as patent infringers, practice deadbeats, clashing colleagues, or "muttonheads," as he sometimes called these disagreeable folks. Frederick B. Noves, his friend since 1892 and a former student, put it this way: "When he presented a paper before a society and someone assailed his ideas with elaborate quotations from the literature and citing of authorities, he could not argue. All he could do was to cuss at them, and call them God damn fools, who they probably were, and they didn't like it."

In his correspondence with friends, he referred to many people by nicknames, epithets, or code-names he created in jest or loathing. James "Jason" N. Mac-Dowell was a classic example of a target for Angle's barbs. Dr MacDowell, the first professor in orthodontia at the University of Illinois, wrote in 1901 a book "Orthodontia: a Text Book for the Use of Students in Dental Colleges and a Hand Book for Dental Practitioners" for dental students that was described best in journal reviews as derivative and uninspired. Angle considered MacDowell a shameless plagiarist and had harsher names for him, such as "Jase the Degenerate," "Mr. J. Sawdust Brains," "The Oracle," "The Thing," "Idiot," and simply "It." He even expressed a few of these pejoratives directly to MacDowell in critical letters.2:384

Angle was unforgiving to those who betrayed him. His brother Mahlon's perceived ineptness in their Montana sheep fiasco of 1881-1882 left Hart with a bitter

taste. Mahlon was the only Angle child to stay on the family farm and work with father Philip, who died in 1907 at 87 years. Mother Isabel's death the following year at age 84 touched off venomous relations between Mahlon and his siblings. Mahlon was committed to continue his parents' dairy farm in Ballibay, and he was successful in buying out the other children's shared inheritance of the property for a pittance through his "bellyaching" and deceit.3:244-248 Hart, livid over Mahlon's selfish and cheating behavior to the family, soon broke off relations with him for good, referring to Mahlon as "that brute" and "the villain."

On the other hand, Edward Angle's good-natured admiration comes through clearly in his letters to long-time friends and loyal supporters. High on his praise list was Dr Guilhermena P. Mendell from Minneapolis, who in 1902 was the first woman to take the Angle School course. He usually addressed her straightforwardly by her nicknames "Quane" or "Mena," but often he teased her with the titles "Colossus of Minneapolis," "Old Doc Mendell," or "President."3:324-325,348-349 He loaned her lantern slides and took the pains to write her detailed instructions on how to give a lecture in the best form possible.3:266-271

In Edward H. Angle, we see a self-made man whom his rivals and competitors respected regardless of his points of view. Two of the most influential orthodontists in New York, Edward Augustus Bogue and Victor Hugo Jackson, both of whom Angle considered enemies, thought highly enough of Angle's work to offer him the orthodontia editorship for the International Dental Journal in 1902. Angle eventually declined.2:730-731

Edward H. Angle in daily life demonstrated most of the characteristics that today are identified as elements of a hypomanic personality, one associated with highly charged, productive, successful people. He was often demanding, intense, enthusiastic, restless, angry, colorful, consumed with confident curiosity, and obsessed with attention to detail. Habitual overwork is a common problem in these overachievers. In 1902, a month past his 47th birthday, Angle was physically depleted from excessive work.2:520 He had lost much weight and was suffering from chronic fatigue and a flare-up of his lifelong respiratory illness. He wisely decided to take a vacation, a 2-month rail trip alone to the Pacific coast, seeking to regain his strengths. It worked, and he made new friends and found new supporters in the process of this recuperation.2:589

Edward C. Kirk, the distinguished Pennsylvania dean and editor of Dental Cosmos, once said to one of his students who came back from the Angle course wide-eyed and excited, "What is there about this man Angle that enables him to take you ordinary guys, who were just mediocre students, and just average dentists

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and make you over into men full of enthusiasm and energy and eager to work." Along with his mechanical genius, Angle's hypomanic nature—his unwavering devotion to orthodontics and his inspirational manner—was probably instrumental in making all the difference to these young impressionable minds. Besides Dr Angle's aura for pointing students to lofty goals, he had the sensibility to recognize intrinsic quality in his candidates and to maintain high standards in his selection of students. In other words, the native talent, ambition, and leadership potential of his carefully screened students invariably would guide them to great future careers after their first-rate initiation at the Angle School.

It should not be forgotten that Edward Hartley Angle's personal vision was wide and deep, not simply confined to his profession. He was keen observer of nature in all its forms. The preamble of the citation accompanying the honorary Doctor of Science degree awarded to Dr Angle in 1915 by the University of Pennsylvania acknowledged his broad intellectual base: "Lover of art and nature, intimate friend of trees and flowers, but preeminently founder of the science of orthodontia. . . ." Angle exercised his intellectualism with an active sociability. He was a worldly man who enjoyed people and places; he was an outgoing celebrant and conversationalist. In addition, he was a talented artist, not only with intricate line drawings and creations for clinical orthodontics, but also in crafting gold jewelry, such as stickpins set with semiprecious stones, which he often gave as gifts to friends.

Furthermore, Angle was an avid collector of things of the world. He gladly received and studied valuable arts and crafts from friends and his grateful foreign correspondents in South Africa, Japan, and elsewhere.^{2:567;3:301–302} Angle asked his well-known orthodontist-friends and mentors for photographs of themselves and other dental celebrities, both earlier and contemporary, to add to his lantern slide collection, which he projected as a historical prelude to his lectures at various meetings.^{1:217;2:567,603} He loved American Indian artifacts, arrowheads and tomahawk heads which he challenged his patients and friends to find and trade to him.^{1:394,796;2:723–724} He collected animal and human skulls and osteological materials in plentiful supply from archeologists excavating the burial 1027



Figure 5. Edward H. and Anna H. Angle in their Pasadena home, surrounded by a display of American Indian textiles and beadwork in this photograph from the 1920s, which was inscribed and sent as a Christmas card. Collecting Native American arts and crafts was an active pastime for the Angles, who amassed over 300 important ethnographic objects.

mounds around St Louis.^{1:508} He and Anna nourished for over three decades an extensive collection of American Indian weavings, beadwork, textiles, clothing, and baskets, mostly from the tribes of the Plains and Great Basin areas of the United States (Figure 5). Most of their archeological and ethnographic collections were donated to institutions and museums in their lifetimes. Almost 300 valuable objects of American Indian ethnography were given by Anna Hopkins Angle from 1930, the year of Edward Angle's death, to 1959, two years after her death, to the museum of Claremont College, now the Pomona College Museum of Art in Los Angeles. It represents a living testament to the broad tastes and intellectual vigor of the Angles.

REFERENCE

Numbers in superscript in this article refer to related Angle letters (volume:page) as published in the comprehensive archival publication cited: Peck S, ed. *The World of Edward Hartley Angle, MD, DDS: His Letters, Accounts and Patents.* 4 Volumes. Boston, Mass: E. H. Angle Education and Research Foundation; 2007. ISBN 978-0-9779524-0-3; available on a non-profit basis at angle@allenpress.com.

Special Article

A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 2

Sheldon Peck^a

PART II

Edward Hartley Angle (1855–1930) had essential gifts of mechanical genius and dexterity, but these traits alone could not have brought him the status of singular greatness in the history of modern orthodontics. There were many other similarly talented individuals interested in "orthodontia" during the specialty's early years. It was Angle's bold, creative drive and his confident powers of persuasion in introducing new and simplifying devices, new methods, and new nomenclature that distinguished him from his peers, then and now.

THE WRITER

As a writer and speaker, Edward Angle was a precise wordsmith, a lecturer of great fluency, and a master at descriptive and colloquial speech (Figure 1). His letters contained within the Angle document archives (1899-1910) were spiced with sentences of rich humor and painterly narrative.1:37-38;2:35;3:196-197 He enjoyed using dialect^{1:751-753} and dry sarcastic wit^{1:25;2:123} to great effect in his letters, after the fashion of his revered contemporary, Mark Twain. By 1909, after his triumphant return to the East Coast as a moneyed celebrity in New York, Angle exuded proudly the prosperity he earned as the fruit of his labors-his orthodontic bookwriting skills and appliance development ingenuity.^{3:305–306} He gleefully boasted to friends and colleagues about the unmitigated success of his brainchild: "Orthodontia is on the boom."3:305

Angle's style of writing was largely verbal: his letters (and probably his speeches) were dictated to and tran-

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Accepted: February 2009. Submitted: February 2009.

 \circledast 2009 by The EH Angle Education and Research Foundation, Inc.

scribed by his talented secretary (and later, second wife), Anna Hopkins. He was gifted with the turn of phrase, using colorful language in original ways, and often waxing effusively in a highly readable way.

Some observers have suggested that Anna deserved much of the credit for the high quality of Angle's written record through her significant literary input during typing. There is absolutely no evidence to support this assertion, given the admirable consistency of Angle's literary output, handwritten as well as typewritten, even during periods when Anna's absence was known, such as when she was attending the College of Dentistry at the University of Iowa from 1900 to 1902. Angle's letters to Anna are just as colorful and articulate as the rest of his correspondence.2:152-154 However, Anna did provide valuable technical skills and judgment. She knew how to craft solid, wellspelled, grammatically correct text. She likely served as a trusted sounding board for her exuberant boss, and she surely must have woven some subtle corrections and softened phrases into his sometimes acerbic commentaries. Dr Angle often appended his own handwritten corrections, notes, or comments to the final typewritten letters. And to almost all addressees, including some close relatives, he hand-signed his letters boldly as "Edward H. Angle." Only with old friends would he let go and sign a creative or diminutive nickname. At rare times during the 1899 to 1910 period, Anna would sign his letters in his absence. Her version of his signature is rather authentic looking, but still recognizably not his own.

For a period in 1901–1902, when Anna Hopkins was away at the University of Iowa studying for her dental degree, Angle's correspondence was managed by his younger sister, Lillian, an accountant by occupation. The technical quality of the letters that "Lillie" attempted to transcribe during that time was noticeably weaker and Angle knew it. He had to apologize often to his correspondents for lateness and errors, and he resorted to handwritten corrections and appended notes more frequently.^{2:254}

Angle recognized that some of the commonplace vocabulary employed in orthodontia could be false or misleading. For example, the world of orthodontia that

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Figure 1. Edward H. Angle at his writing desk in his Pasadena, California home, mid-1920s.

Angle entered in the 1880s was one engaged primarily in "tooth regulation," procedures and mechanisms geared to make crooked teeth less irregular. Hardly any attention was given by the patient or doctor to the role of occlusion or bite discrepancy in the etiology of tooth irregularities. Early on, Angle became convinced that anomalies of molar occlusion were prime factors in the origins of most orthodontic problems, including dental crowding. Thus, he took the bold step of popularizing the word "mal-occlusion" in the late 1890s. around the time he was creating his landmark work "Classification of Malocclusion." Published in 1899, that article brought order out of chaos, simplicity from existing diagnostic complexity, transformations that Angle's creative mind seemed particularly adept at seeing and doing. Quickly, he changed the title of his textbook from a prosaic "The Angle system of regulation and retention of the teeth . . . " (1890-1899) to the then ground-breaking concept, "Treatment of malocclusion of the teeth . . . " (1900, 6th edition).

Angle was a perfectionist whose painstaking exactness in his scientific thinking and writings became a hallmark of his lifetime of work in orthodontics. His detailed letters to managers and book editors of the SS White Dental Manufacturing Company show him as a polymath with a remarkable understanding of the tasks of typesetter, illustrator, and publisher.3:82-90 Angle edited his book six times over, modifying and adding to it every time, as his own expertise developed and progressed, turning what began as a 20-page article in 1887 into a 628-page text in 1907. He always seemed to be at work on an address, an illustrated presentation, or publication. He prepared by hand many of his intricate drawings and by 1900 had a library of over a thousand glass lantern-slides for projection. Besides his well-known textbook editions, Angle wrote around 80 articles for publication in various professional journals in the United States, Europe, and Australia be-

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tween 1887 and his death in 1930.^{3:766–772} In addition, during his lifetime, close to 100 abstracts and commentaries about his work were published.^{3:772–775} Another 150 articles are recorded in the indexed scientific literature about Edward Angle and his legacy, and this number continues to grow.^{3:775–784}

In addition to his own writing, Angle's letters show that he served enthusiastically as a mentor in scientific writing and editing, long before the era of peer review. He generously volunteered ideas and topics for former students and colleagues, including one of his first four students, Milton T. Watson,^{1:203–205} longtime friend William J. Brady,^{1:211} and brother-in-law/editor Cy Camp,^{2:240–241} who was essential in the final editing and proofing of the sixth edition (1900) of Angle's textbook. Angle conscripted all of them and three other colleagues to write popular articles to increase public awareness of the young specialty of orthodontia in the first decade of the 20th century.^{2:214–216}

Minneapolis merchants Robert Foster and Otto Keidle remained close friends with the Angles from their formative years there. In the Angle letter archive from 1899 to 1910, "Bob and Otto" (also called "White Child and Baron") received some of the most entertaining yarns and homespun dialects from an Edward Angle at his charmingly best.^{1:1-3} Angle, who no longer used his childhood name "Hart" with newly acquired friends, still often signed off humorously as "Rube" or "Reuben" or the like.^{2:294} In his well-written personal ramblings to friends, Angle's broad and deep nonprofessional interests in people, poetry, literature, history, and the world came through clearly.^{1:103,151–152;2:232}

THE INVENTOR

Edward H. Angle's correspondence and patents reveal features of the most dynamic side perhaps of this multidimensional man: the rapt and consummate inventor, a human wellspring of new ideas (Figure 2). During his lifetime, Angle applied for and received 45 patents (his wife Anna obtained his 46th patent in 1934, four years after his death). Most were appliances and instruments related to clinical orthodontics, but they included laboratory equipment and a novel automobile wheel. His contemporary role models were likely among the new breed of inventive, risk-taking industrialists, such as Thomas Edison, George Eastman, and Charles Kettering. America led the world by the beginning of the 20th century in technological innovation and entrepreneurship. In the first years of the 1900s, American medicine was ablaze with new light and directions for the medical and dental community. At Johns Hopkins University, William Osler initiated creative reforms in clinical education and single-handedly systematized the field of internal medicine. At

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Figure 2. Dr Angle, the inventor, at his workbench in Pasadena, mid-1920s. There is evidence that he was ambidextrous in his prodigious mechanical skills.

Northwestern University, Greene Vardiman Black introduced the nomenclature of tooth anatomy and the modern principles and tools of operative dentistry.

Edward Angle's rationale for patenting his inventions was to take legal claim of his ideas and to protect his business interests.^{1:126–128;3:372} However, many of Angle's colleagues criticized him for the zeal with which he protected his breakthrough appliances and systems for doing "tooth regulation" and "orthodontia" more easily. Patent protection certainly makes sense in today's high-stakes environment of corporate espionage and intellectual property rights, but in Angle's time, patenting—particularly in medicine—was viewed in many circles as selfish and mercenary.

Angle's enthusiasm for advancing the materia technica of orthodontics was so strong that he freely mentored, encouraged, and worked with colleagues in their efforts to develop new appliances. This is seen in Angle's letters to Henry A. Baker of Boston in which he praises the "Baker method of anchorage"^{1:229} and later seeks to protect Baker's professional reputation as the first to use intermaxillary anchorage2:667-669,784 against equal claims made by Calvin S. Case of Chicago. It is also apparent in his letters to E. L. Townsend where he encourages Townsend to write and publish articles concerning Townsend's idea for a prosthetic bridge appliance.2:622 Angle worked cooperatively with several of his former students to develop orthodontic appliances and instruments: Jacob Lowe Young, Spencer R. Atkinson and Albert H. Ketcham each jointly held patent rights to one or more inventions with Angle.* Furthermore, trusting the biomechanical acumen of his former student Milton T. Watson, Angle asked him to try out competitors' orthodontic appliances and to conduct a comparative study and report back to Angle with his conclusions.^{2:279–280}

Angle, the enterprising innovator, worked and reworked designs to develop the best appliances. As President of the E. H. Angle Regulating Appliance Company, incorporated in St Louis in May 1907, he kept track of the work of other inventors active in the budding field of orthodontia and maintained a folder with relevant patents filed by others. Within the 11year record of correspondence covered by the Angle letter archives, he relentlessly hounded those he perceived as idea stealers, patent infringers, and plagiarists—Drs. Clarence D. Lukens, James N. MacDowell, and Miland Knapp, and manufacturers Julius Aderer, Claudius Ash, and Blue Island Specialty Company. In anger, he slapped some with lawsuits and inflammatory defamations.

The age-old rule that brilliant inventors make poor business people did not apply to Edward H. Angle. He was in fact the consummate, confident businessman, maximizing income and minimizing expenses. Angle was a demanding taskmaster in his detailed letters to the machinists to whom he outsourced appliance manufacture at various times: William Hahn, the Hardinge brothers, and John E. Canning. They were required to fabricate his devices with tight tolerances and on tight budgets.[†] He held the SS White Dental Manufacturing Company, which by 1895 became the exclusive distributor of the Angle System, to a rigorous Angle-controlled business relationship. His detailed handwritten invoices from the "E. H. Angle Regulating Appliance Co" show his (and Anna's) arithmetic accuracy in billing to the penny, making a lie of his schoolboy reputation of being weak with numbers.

THE PROFESSIONAL

Dr Angle was an inspiring teacher and professional role model for his students. His patients saw him as a devoted, caring, and hard-working doctor. His acquaintances and friends viewed him as an upstanding citizen with personal magnetism and delightful wit (Figure 3a,b). He focused a large measure of his life to fostering and molding orthodontics as a self-standing specialty, a profession unto itself. The whole purpose of his Angle School of Orthodontia was to create a community of professionals locally, nationally, and internationally. As he expressed it, "Besides making this an ideal school for teaching this interesting science, I want it to be more than that. I want each class to be

^{*} References 3:590–593, 608–615, 699–703.

[†] References 1:35, 71-73, 144-145; 3:407-408.

ANGLE BIOGRAPHY



Figure 3. (a) Despite his somewhat austere look, always dressed in starched wing collar and tie (portrait photo, mid-1920s), Edward Angle's letters reveal him as a person of great sociability, charm, and wit. (b) Here, he clowns for the photographer at his cabin in the San Gabriel Mountains near Pasadena, while Anna prepares food in the background (1919).

a federation of friends and enthusiastic workers for the new science."2:288

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With unsurpassed content and style, and a growing network of influential former students touting his greatness, Edward H. Angle was in great demand as a lecturer. He was a passionate and informed speaker, and had descriptive visuals to project about orthodontia that most presenters did not have. His treatment approaches were ingenious for his time. Many of his ideas, such as the buccal tube and the "edgewise" mechanism, have survived the test of time and are still fresh and useful in everyday modern orthodontics. During his St Louis and New London years documented in his letter archive, he kept a full schedule of speaking engagements and actually turned down many invitations to speak. Those lectures he wrote about are cited in the Angle Archives book under the subject index entry for "Speaking Engagements."^{3:815}

Angle was a mentor in the fullest sense of the word. He continued to provide direction and advice to his students long after they completed his course. He spent time writing friendly instructive letters particularly to some of his favorite early graduates, including Lloyd S. Lourie,^{2:321} Milton T. Watson,^{1:265–266} and Guilhermena Mendell.^{3:396} Several of his students (eg, Norman Reoch and Herbert Pullen) stayed on for a while after graduation to be Angle's office assistants, permitting more interaction and learning.^{1:320;2:689}

Encouraging letters with personal advice were exchanged with colleagues who did not graduate his course, but for whom he had a liking. For example, he had a rich correspondence mentoring two dentists whom he taught in the late 1890s at Marion-Sims College of Medicine in St Louis, and who spent some time in his office before the creation of the Angle School: Herman T. Spann^{2:38–39} in Germany and Arthur C. Edmonds^{1:208–210} in South Africa. Angle wrote supportive words even to former students who dropped out of his course for personal reasons, such as E. H. Stanley^{1:607} of Seattle, Washington. Perhaps his most tender counseling was the support and encouragement he gave his secretary Anna Hopkins to attend dental school, graduating from the University of Iowa in 1902.2:152-154 Afterward, she returned under Angle's wing as an informal student and teacher at all future sessions of the Angle School, although she never actually practiced dentistry or orthodontics. Their famous compatibility and years of teamwork blossomed into a lasting marriage in 1908.

Edward Angle, who raised his opinionated voice about so many things and people in his professional sphere, was surprisingly apolitical. Comments in his letters about current events, personalities, and world affairs were remarkably rare. Of the little we may deduce, he was a pacifist who avoided politics and detested imperialism.^{1:625-626}

His idealism about orthodontic education was anchored deeply in his bones. Angle was generous in giving free advice to inquiring doctors,^{2:396–398} and he proudly proclaimed that he "never received a farthing" directly off his school.^{3:432} That was indeed true. His altruism was partly driven by his perception that orthodontia needed a legion of trained practitioners in order to be recognized as a specialty. He also knew that the more orthodontists he trained to use his appliances, the better would be his chances for a lifetime annuity from appliance-sale royalties. Therefore, he taught many financially strapped students without charging them tuition.^{2:362,479;3:420} In 1902, he wrote of his dream to run a free-of-charge school, for both student and patient.^{2:451} Twenty years later, in Pasadena, the Angle College of Orthodontia became his dream-come-true with complete financial support provided by his grateful alumni, many of whom remembered Angle's generosity to them when they most needed it.

Paradoxically, as much as Angle was a practicing idealist about access to education based on merit, he was intractably stuck in the 19th century on some professional issues of the day, such as fee-splitting and student decorum. Through 1908, his last days in St Louis before his retirement from the active practice of orthodontia, Angle routinely gave 20% of his specialist's fee to the referring general dentist as a commission. Thus, he wrote many short perfunctory letters to accompany his checks to the referring doctors. This kind of kickback scheme was standard practice in American medicine at the time, but the times were changing rapidly at the beginning of the 20th century. New graduates rejected fee-splitting practice as unethical, and soon it was completely outlawed. Early in the life of the new American Society of Orthodontists (ASO), this problem was confronted, to the dismay of Dr Angle and many of his older contemporaries who viewed the issue as trivial. Regarding the behavior of students, Angle demanded military-style obedience and agreement on the part of his Angle School students. Four of his students in 1906 questioned Angle's lectures to such a vocal extent that he expelled them all from his course. This matter became a cause célèbre at the ASO Board of Censors, who ultimately sided with one of the dismissed students (Hubert C. Visick) and prompted ASO founder Edward H. Angle to resign with characteristic 19th-century gravitas.3:342,505-507

On the other hand, Angle showed a sympathetic, almost paternal concern for his patients.^{1:73–74,109–111,112–114} Some he tried to coax into better cooperation with wellchosen words in his letters. Others he gently or not-sogently prodded because of missed appointments or nonpayment of account. He personally seemed to know much about each member of his family of patients. He enjoyed establishing some lasting doctor-patient relationships in which patients continued to correspond with Angle long after treatment and even after his retirement from practice.^{3:260–261}

SUMMATION

As a coda, can anything be presented about multifaceted Edward H. Angle—short of recommending perusal of his extensive papers published in the Angle Archives multi-volume sourcebook—to highlight further the persona and world of this legendary figure in the history of medicine? Today, almost 80 years after his death on August 11, 1930, those who knew Dr Angle personally are deceased too. Through the inexorable progression of years, Edward Angle, like others of olden fame, has faded from being a familiar personality to being merely a recognizable name. Two illuminating tributes from close contemporaries offer personal reflections on the man.

One was written by Martin Dewey, DDS, MD, who stood among the most accomplished of Angle School graduates. It was published as his editorial for the first issue of *The International Journal of Orthodontia* in 1915, when Angle was approaching 60 years of age:

It is well known that Dr Edward H. Angle is the Nestor of orthodontia. To him, more than to any other individual, is this science indebted. His life has been spent nursing and developing it.

To practically every dentist today throughout the world, orthodontia is synonymous with Dr Angle's name. Few men have the privilege of living to see the child of their creation in science develop to that degree of efficiency which orthodontia now so rightly enjoys. Most pioneers in the field of science only find the trail; Dr Angle not only blazed the trail, but he today enjoys the rare pleasure of seeing this pathway trodden by the multitudes who seek information at this shrine.

All those who have had the privilege of intimate acquaintance with Dr Angle know how jealously he has guarded orthodontia. To keep it out of the hands of the incompetent and thus prevent it being besmirched by faulty results has been his one ambition. To this end he has constantly striven, constantly lifted his voice, and constantly cautioned his students throughout the length and breadth of the land.

The International Journal of Orthodontia *in* this, its initial number, pays a tribute of respect to the work of this great man. His ideals of service, of thoroughness, of care and attention to detail, perfect results, and devotion to one's work, will ever be its motto.

In the final analysis, Anna Hopkins Angle, DDS, may have given us the best simple characterization of Dr Angle. She knew this complex man better than anyone did. In 1932, two years after Angle's death, she submitted a solicited biographical sketch of her famous husband for *The National Cyclopædia of American Biography*. In addition to the requisite dates, places and happenings, she inserted three defining sentences that probably reflected how the Angles wished Edward Hartley Angle would be remembered. Her earnest words, understandably hagiographic, still express one of the most fitting tributes we may bestow on this extraordinary prime mover in the evolution of orthodontics:

ANGLE BIOGRAPHY

Dr Angle was a thinker of vision and imagination and a lover of the beautiful in character, art, and nature. He was fond of children, literature, and outdoor life. He lived and worked intensely and gave always the best his mind and hand could evolve to advance the profession of which he was the founder and leader.

REFERENCE

Numbers in superscript in this article refer to related Angle letters (volume:page) as published in the comprehensive archival publication cited: Peck S, ed. The *World of Edward Hartley Angle, MD, DDS: His Letters, Accounts and Patents.* 4 Volumes. Boston, Mass: E.H. Angle Education and Research Foundation; 2007. ISBN 978-0-9779524-0-3; available on a nonprofit basis at angle@allenpress.com.

Special Article

A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 3

Sheldon Peck^a

BIOGRAPHICAL CHRONOLOGY, 1855–1930

Date	Event
June 1, 1855	Edward Hartley Angle born to Philip Casebeer Angle (1820–1907) and Isabel Erskine Angle (1824–1908) in District 1 "Ballibay," Herrick Township, Bradford County, Penn- sylvania. The fifth of seven children. Demonstrates early talent for using tools and de- vising and constructing machinery, including a hay rake (at age 11); attends high school in Canton, Pennsylvania.
1874–1876	Apprentices with a local dentist in Herrick.
Fall 1876– February 1878	Attends the Pennsylvania College of Dental Surgery in Philadelphia, receiving DDS de- gree on February 28, 1878; begins practicing dentistry in Towanda, the county seat of Bradford County, Pennsylvania. Here he develops an interest in orthodontia.
Spring 1881	Develops a chronic respiratory ailment, called pleural pneumonia, probably tuberculosis.
Autumn 1881	Moves to Minneapolis, Minnesota, for health reasons. Within months, his health recovers and he returns to Pennsylvania briefly to join his older brother Mahlon and friends in planning a sheep-raising venture in Montana.
Late 1881	Moves to Montana with associates to enter the sheep-ranching business.
Early 1882	The severe winter of 1882 kills their sheep flock and dooms the venture financially.
1882–1883	Relocates to Minneapolis and resumes the private practice of dentistry; continues his interest in orthodontia.
1886	Accepts position as professor of histology and lecturer on comparative anatomy and or- thodontia in the Dental Department of the Minnesota Hospital College in Minneapolis. Two years later, it becomes part of the University of Minnesota, and he is elevated to professor of orthodontia. Maintains his part-time private practice of dentistry.
March 1887	Marries Florence A. Canning (1865–?) of Minneapolis, sister of his machinist John E. Canning.
September 8, 1887	Presents his first major address describing aspects of the Angle System of Regulating Ap- pliances before the 9th International Medical Congress in Washington, DC. Angle's origi- nality is challenged in the heated discussion that ensues. Angle later considers a 14- page extract of this paper, published without discussion in an 1887 textbook by Loomis P. Haskell, as the "first edition" of the seven American editions of his famous book.
December 3, 1887	Daughter Florence Isabel Angle is born in Minneapolis. (She died in 1970 in Morgan- ton, North Carolina.)
1888	Elected president of the Minneapolis City Dental Society.
March 5, 1889	Patents a jack-screw mechanism, the first of 46 patents held by Angle.
1890	"Second edition" of his book is published, as a 30-page appendix to the second edition of a dental laboratory handbook by Loomis P. Haskell.

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Accepted: February 2009. Submitted: February 2009.

 $[\]ensuremath{\textcircled{\sc c}}$ 2009 by The EH Angle Education and Research Foundation, Inc.

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1892	Resigns from the faculty at the University of Minnesota; limits his practice exclusively to orthodontia, thus becoming ostensibly the world's first specialist in orthodontia.
1892	Hires Anna Hopkins (1872–1957) of Minneapolis as his secretary and office assistant.
1892	Publishes third edition, a 51-page pamphlet entitled, <i>The Angle System of Regulation</i> and Retention of the Teeth.
1892–1898	Professor of orthodontia at the American College of Dental Surgery (later merging into Northwestern University School of Dentistry) in Chicago.
1894	Appointed Surgeon to the Great Northern Railroad for the treatment of fractures of the maxillae.
1895	Fourth American edition is published, a 112-page hardcover book now titled, <i>The Angle System of Regulation and Retention of the Teeth and Treatment of Fractures of the Maxillae.</i>
1895	Relocates to St Louis, Missouri (with his wife Florence, his daughter Florence Isabel, and his secretary-assistant Anna Hopkins); sets up a private practice there limited to orthodontia.
1896–1899	Professor of orthodontia in the Dental Department of Marion-Sims College of Medicine, St Louis.
1897–1898	Teaches in the Dental Department of Washington University, St Louis.
1897	Fifth American edition is published by SS White, Philadelphia; also, a German transla- tion of his fourth (1895) American edition is published by SS White Co, Berlin.
1897	Is awarded MD degree from Marion-Sims College of Medicine.
1899	Dental Cosmos publishes Angle's "Classification of Malocclusion," his most important journal article to date.
1899	Claudius Ash publishes Gustave Darin's French translation of Angle's book under the title <i>Methode du Professeur Angle Pour la Régularisation et le Traitement des Dents et Pour le Traitement des Fractures des Maxillaires.</i>
June 6, 1899	Patents the E-Arch, his expansion archwire mechanism.
August 1899	Angle's paper on orthodontia prepared for presentation at the National Dental Associa- tion meeting at Niagara Falls is bypassed at the last minute by program officials. This personal slight fuels Angle's desire to found a postgraduate school of orthodontia and a professional society devoted to orthodontia.
November 1899	Teaches a postgraduate course on orthodontia in his office in the Olivia Building, St Louis. Attending are Thomas B. Mercer, Henry E. Lindas, Herbert A. Pullen, and Mil- ton T. Watson.
December 8, 1899	Resigns his appointment at Marion-Sims College of Medicine.
1900	Founds the Angle School of Orthodontia; first 5-week course is held from May 1 through early June 1900 in the Odeon Building, St Louis.
July 1900	Separates from wife Florence Canning Angle.
October 1900	Publishes sixth edition, a 315-page work, <i>Treatment of Malocclusion of the Teeth and Fractures of the Maxillae. Angle's System.</i>
Early 1901	Founds the Society of Orthodontists (antecedent of the American Association of Ortho- dontists) and serves as its first president.
Early 1901	Founds the Society of Dental Science of St Louis.
July 1901	First meeting of the Society of Orthodontists (renamed in 1902, the American Society of Orthodontists) is held in St Louis, Missouri.
1902	With Angle's encouragement, Anna Hopkins graduates from the University of Iowa with a DDS degree.
December 1902	Offered the editorship in orthodontia of the <i>International Dental Journal</i> ; Angle declines the offer.
August 29– September 3, 1904	Chairman of Section VI (Orthodontia) of the Fourth International Dental Congress, St Louis.

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1904	German translation of his fifth (1895) American edition is published by SS White Co, Berlin.
1905	Contributes chapter on orthodontia in Edward C. Kirk's <i>American Textbook of Operative Dentistry</i> (also in 1911 edition, revised).
Spring 1906	Resigns membership in American Society of Orthodontists; encourages establishment of The Alumni Society of the Angle School of Orthodontia (earliest forerunner of The Edward H. Angle Society of Orthodontists).
Winter 1906–1907	Retires from practice of orthodontia in St Louis; focuses on writing seventh American edition of <i>Treatment of Malocclusion of the Teeth, Angle's System</i> (628 pages).
1907	Father Philip Casebeer Angle dies, age 87.
May 1907	Incorporates the E.H. Angle Regulating Appliance Co, in St Louis, Missouri.
June 1907	Founds <i>The American Orthodontist</i> , the first journal in the world devoted exclusively to orthodontics (discontinued in 1912); it is the forerunner of <i>The Angle Orthodontist</i> .
1908	Mother Isabel Erskine Angle dies, age 84.
May 1908	Divorces Florence Canning Angle in Minneapolis, Minnesota.
June 27, 1908	Marries Anna Hopkins in St Louis, Missouri.
Summer 1908	Moves from St Louis with wife Anna H. Angle to Larchmont, New York.
September 15– October 31, 1908	The Angle School of Orthodontia is in session in New York City for a 6-week course, in an office building at the corner of West 72nd Street and Broadway.
Fall 1908	Hermann Muesser publishes Josef Grünberg's German translation of Angle's sixth (1900) American edition under the title <i>Behandlung der Okklusionsanomalien der Zähne.</i>
April 1909	Purchases home at 58 Bellevue Place, New London, Connecticut.
July 1909	Wins patent infringement suit against appliance manufacturer Julius Aderer.
October– December 1909	The Angle School of Orthodontia moves to New London, Connecticut; course session lengthened to 9 weeks, given in the Munsey Building.
July–September 1911	Second (final) course session in New London at the Harbor School, after which Angle closes Angle School of Orthodontia due to his declining health.
1913	Revised and expanded German edition of Angle's book (1907 American edition) is pub- lished with new chapters by Josef Grünberg and Albin Oppenheim (778 pages).
February 22, 1915	Awarded Honorary ScD degree by the University of Pennsylvania.
Late 1916	Angle moves to southern California for health reasons; purchases home at 1025 North Madison Avenue, Pasadena.
1917	At request of James C. Angle (no relation), he reopens the Angle School of Orthodontia at his home in Pasadena.
1922	Edward H. Angle Society of Orthodontists is started in California by graduates of the Angle School of Orthodontia.
1922–1923	Grateful students fund construction of a building in Pasadena for the Angle School of Orthodontia at 550 Jackson Street, next to Angle's home; it is dedicated on January 8, 1923.
1924	The Angle College of Orthodontia and Infirmary is chartered by California. No tuition is charged for the College's 12-month program (which is followed with periodic faculty supervision during the first year of private practice). All patients are treated free of charge.
September 15, 1925	Patents the edgewise arch mechanism.
Late 1927	The Angle College of Orthodontia closes unofficially due to Angle's deteriorating health.
August 11, 1930	Edward H. Angle dies in Santa Monica, California, at age 75 from heart failure; burial at Mountain View Cemetery, Altadena, California.
November 17, 1930	The Angle Orthodontist, a scientific journal devoted exclusively to orthodontics, is founded in Chicago in Dr. Angle's memory by the newly reorganized Edward H. Angle Society of Orthodontia.

Evidence-Based Damon System: Part II

Is the Damon system faster than the conventional system in alignment? It depends!

Recently those orthodontists who don't like to use the Damon system, often quote Pandis's article¹ which compares the two systems in nonextraction treatment and Scott's article² of comparison in extraction treatment. Their common emphasis is that the Damon system is not faster than conventional brackets for initial alignment. The author would like to discuss these two articles in further details.

A. About Pandis's Article 1

Self-ligating vs. conventional brackets in the treatment of mandibular crowding: A prospective clinical trial of treatment duration and dental effects.

Pandis N, et al. Am J Orthod Dentofacial Orthop 2007;132:208-15

Methods	Conclusions
 54 patients satisfying the following criteria Nonextraction treatment No spaces in the mandibular arch Irregularity index greater than 2 in the mandibular arch No therapeutic intervention planned with any extraoral or intraoral appliance The patients were randomly assigned to 2 groups: Damon self-ligating bracket, Microarch conventional edgewise appliance 	 No difference in time to correct mandibular crowding. For moderate crowding (irregularity index < 5) Damon 2 - 2.7 times faster. For severe crowding (irregularity index > 5) marginally insignificance. Damon 2 group showed statistically greater intermolar width increase than the conventional group. Alignment-induced increase in the proclination of the mandibular incisors was observed in both bracket groups.

Fig. 1: Pandis's article, comparing nonextraction cases.

Lin's Comments

- 1. Sample selection by irregularity index greater than 2. Those of irregularity index < 5 are defined as moderate crowding, irregularity index > 5 as severe crowding. All these irregularity index criteria are too small to demonstrate the capability of Damon brackets to correct severe crowding.
- 2. For severe crowding, the alignment mechanics are different between the Damon 2 and conventional brackets. However, the study didn't mention the details of how the teeth were aligned. Whether open coil spring was used or not? Where all the wires engaged on most of brackets from the beginning?
- 3. An alignment-induced increase in the proclination of the mandibular incisors was observed in both bracket groups. It confirms the author's view that there is no lip bumper effect in nonextraction Damon appliance treatment³. Most of the time it is acceptable for Caucasian with a flat or concave profile. For oriental patients with fuller profile it should be very careful. Otherwise patients may end with bimaxillary protrusion after crowding is relieved.



President of TAO (2000~2002) Author of *Creative Orthodontics*

Dr. John Jin-Jong Lin MS, Marquette University Consultant of NTO

B. About Scott's Article 2

Alignment efficiency of Damon3 self-ligating and conventional orthodontic bracket systems: A randomized clinical trial.

Scott P, et al. Am J Orthod Dentofacial Orthop 2008;134:470.e1-470.e8

Fig. 2: Scott's article, comparing extraction cases.

Methods

- 1. A multicenter randomized clinical trial was conducted in 2 orthodontic clinics.
- 2. 62 subjects, 32 male, 30 female, mean age 16.27 years.
- 3. Mandibular incisor inregularity index of 5 to 12 mm.
- Prescribed extraction pattern included the mandibular first premolars.
- Were randomly assigned to treatment with Damon 3 self-lighting brackets or Synthesis conventionally ligated brackets.

All patients required extraction of the mandibular first premolars Randomized (n=62)				
\sim >				
Allocated to Damon 3 (n=33) Received allocated intervention (n=33)	Allocated to Synthesis (n=29) Received allocated intervention (n=28) Did not receive allocated intervention (n=1) Reasons - decided against treatment			
Lost to follow-up (n=0) Requested removal of appliance (n=1)	Lost to follow-up (n=0)			
Analyzed (n=32) Excluded from analysis (n=0)	Analyzed (n=28) Excluded from analysis (n=0)			

Fig. 3: Scott's guideline of case selection. They were selected without proper diagnosis. All cases had two lower first premolars removed just because their irregularity index fell between 5-12 mm.

Conclusions

Damon 3 self-ligating brackets are no more efficient than conventional ligated pre-adjusted brackets during tooth alignment.

Lin's Comments

- 1. For the consecutive patients with mandibular irregularity from 5 to 12 mm, and absence of a complete deep bite, the two mandibular first premolars were removed. However, it's very dangerous to remove two mandibular first premolars due to the mandibular irregularity of 5-12 mm. If extraction was performed on flat to concave profile, which is quite common among Caucasian patients, it will create a dished-in profile. A class II will get worse after extraction of lower 1st premolar treatment. Nowadays with Damon appliances can correct the crowding 5 -12 mm easily and maintain healthy periodontal tissues. A lot of Caucasian patients with a good profile and crowded dentition can be corrected with the Damon system ⁴.
- 2. In the editor's interview ⁵ with Cobourne, author in the study, he said that "I think most orthodontists would extract premolars if the patient had an irregularity index of 12 mm". In this study one patient was diagnosed with irregularity index 5-12 mm, and had all the lower first premolars removed without any consideration of the original profile. Even for patients with irregularity index greater than 12 mm, they still can be correct easily with the Damon system.
- 3. The study also states that "fully ligated 0.014-in Nickel-titanium archwires were used first in both groups". To treat severe crowding with traditional edgewise brackets, open coil springs are frequently used to gain space before engagement. When using the Damon system in this kind of case, all the wires can be fully engaged at the beginning. If orthodontists are not familiar with the Damon system, the way of engagement should be different. As such the treatment time will be different. In the study there were no details provided regarding alignment and the use of coil spring. Without such information it's not fair to compare the speed of alignment.
- 4. In the sections regarding materials and methods the mandibular irregularity range fell between 5 to 12 mm. However, the results indicated that the mean irregularity at T1 of the Synthesis group is 12.44 mm. These two sets of numbers contraindicated each other. The mean irregularity should have been smaller than 12 mm had the sample selection followed the original methods as stated.
- 5. How could you assign consecutive patients randomly to traditional twin brackets and Damon 3 brackets? It's unethical to randomly assign patients to two totally different bracket systems without consideration of their diagnosis and the strength of each system.
- 6. Considerable difficulty and bracket failure in the Damon 3 group were reported. However, the final comparison didn't ruled out these failure cases. These bracket failure cases definitely influenced the speed of alignment. This inclusion should be explained in the result or should be excluded in the comparison.
- The irregularity index of 5-12 mm cannot fully represent the capability of Damon brackets in crowding relief. The irregularity index should be increased to 12-20 mm. In addition, the periodontal tissue change on the anterior teeth should be studied.

C. Discussion

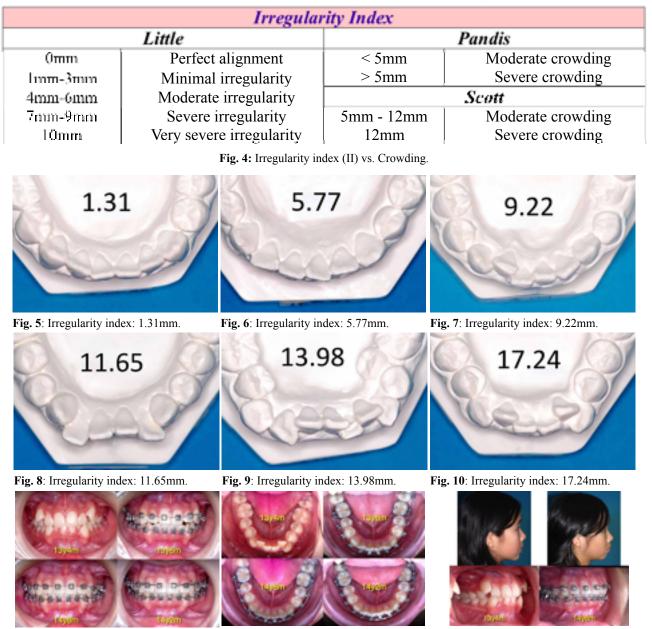


Fig. 10A

Fig. 10

Irregularity index: 17.24mm of mandibular arch, a severe crowding case with a flat profile at the beginning. Alignment was achieved in merely 4 months using the Damon system. After the alignment stage, even though as mentioned in Pandis's article the lower incisors proclined, the profile is acceptable. After relieving severe crowding, the patient still has healthy gingival tissue. This case, if treated according Scott's extraction guideline, should have been an extraction case. However, it'll create a dished-in profile. Meanwhile. It is impossible for conventional edgewise brackets to treat severe crowding without extraction.

Fig. 10C

Fig. 10B

Pandis's classification ¹ of crowding tends to be exaggerated compared to Little's original description ⁶. Even though Scott's classification ² of crowding is closer to Little's original description, there are still many problems in this study.

- 1. The orthodontist may not be familiar with the Damon system.
- 2. Neglect the delay of alignment due to Damon 3 bracket failure.
- 3. Poorly designed extraction treatment. It only takes account of crowding but not profile. In comparison of the irregularity index and crowding, from Fig 4 to Fig 10, we can see the irregularity index demonstrating the capability of Damon system. Scott's article not only neglected diagnosis but also failed to account for failure cases of the Damon 3 brackets and the subsequent delay. Hence the credibility of this reference is undermined.

On the Fig 10, this is a Taiwanese girl with a flat profile. Even though her irregularity index scored as high as 17.24 mm, she still chose the Damon nonextraction treatment. The severe lower crowding was quickly aligned. After the treatment the patient still maintained an acceptable profile and good periodontal health.

#	Case	Age	Tx Time	Retention Time
1	MJ	14y6m	14ms 2wk	
2	TS	43y1m	15ms 1wk	
3	HH	17y2m	18ms 2wk	6ms
4	SH	15y3m	18ms 2wk	10ms
5	TB	32y9m	18ms 2wk	
6	СВ	13y6m	33ms 2wk	2yr 6ms
7	KH	11y7m	21ms 2wk	
8	KP	12y5m	17ms	1yr
9	TBM	40y10m	18ms 1wk	
10	HH	47y1m	21ms 2wk	

Fig. 11: Treatment time in Damon's workbook.

Besides the case CB, most of the difficult nonextraction cases cited in the Damon workbook, including adult patients, finished in 2 years. For cases of similar level of difficult crowding cases in the author's office, they were treated not as fast and as well as Dr. Damon did. The treatment speed depends on every orthodontist's individual styles and techniques even with the same system. So it's very difficult to evaluate the Damon brackets versus the traditional brackets in the alignment rate.

The alignment rate is indeed much faster in severe crowding cases in the author's hands. But the most important thing in our practice, is, as well put by Dr. Damon in the 2006 Phoenix American Damon forum, "to challenge and commit yourself to be a far better orthodontist today than you were yesterday." After using Damon, compared to myself in the past, indeed I am a far better orthodontist now than before using Damon and temporary anchorage devices.

Conclusions

- 1. Pandis's comparison on irregularity index greater than 5, is too low to demonstrate the full capability of the Damon system to treat severe crowding.
- 2. Scott's study didn't have detailed description of the mechanics used and neglect to account for D3 failure cases. Hence, the conclusion is questionable.
- 3. The author's clinical experiences indicate that in mild to moderate crowding cases, Damon alignment may be not much faster than conventional appliances. But in severe crowding cases, the Damon system can not only relieve crowding quickly but also maintain good periodontal health.
- 4. In addition to its efficiency and effectiveness in treating severe crowding and preserving good periodontal health, there are following advantages to think about when evaluating the Damon system:
 - (1) Increase patient visit interval, shorter visit time, save orthodontist's chair time, less pain ^{7,8}.
 - (2) Achieve maxillary arch expansion gently while preserving good periodontal health more easily than rapid heavy force palatal expansion.
 - (3) Due to the play between wires and brackets, there is a MEAW effect (Multiloop Edgewise Archwire). The effect makes it much easier to fit both arches together, a strong benefit for difficult cases like Class II, Class III, open bite and asymmetry cases!
 - (4) High quality brackets. You can get rid of Damon 2 for its difficulty in manipulation and Damon 3 for vulnerability. Now the Damon 3MX and the latest Damon Q are very easy to manipulate. The Damon Q even makes the opening and closing of the slide much easier. There are much more pre-torque brackets to select in this latest series.

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<< Journal Review >>

Things You Want to Know About SLB

在建入真正的主题之前,我想先提一下所谓的 Hype cycle Hype cycle (技術成熟度曲線模型,或稱為炒作曲線) 是全球IT諮詢、分析機構Gartner group於1995年所引進的的曲線模型,主要是用來分析新科技/技術-由觀念的產生到 被市場接受的過程。Gartner利用它觀察、預測各種新科技被企業的接受程度與落實狀況。目前廣泛應用在新技術/科 技行銷中,提供決策者在採用新科技/技術時做策略分析之用。

參考下圖, Hype cycle 由左至右可分為五個階段(橫軸為時間,縱軸為能見度):



1. Technology trigger. 新技術的觸發

新科技/技術的創新或是新產品的發表,因為其話題性(或是前瞻性?)引起廣泛媒體大眾的注意。

- 2. Peak of inflated expectations. 誇大的期望高峰
 - 狂熱的使用者往往對新科技/技術過度理想化,抱著不切實際的期望。此時新科技/技術的使用可能 會有零星的成功經驗,但是大多以失敗收場。
- 3. Trough of disillusionment. 冷卻期

過度的期望帶來相當的失望,這個可能還不夠成熟的科技/技術因為無法達到使用者的期望,很快 的就退流行了,也無法再得到媒體或是大眾的注意。

4. Slope of enlightenment. 又見一線曙光

雖然失去媒體的青睞,某些使用者仍專注的探索這個新科技/技術,最後熬過不斷的嘗試與驗證過 程,因而在其可應用範圍,潛在的利益與可能的風險方面得到了真正的了解。

5. Plateau of productivity. 生產力的高原

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此時,這個新科技/技術真正的被這現實世界接受。隨著第二代第三代的產品(或是技術理論)
漸次推出,表現也漸漸穩定,成為主流產品。
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(關於Gartner hype cycle請參考<u>http://www.gartner.com/it/products/hc/hc.jsp</u>)

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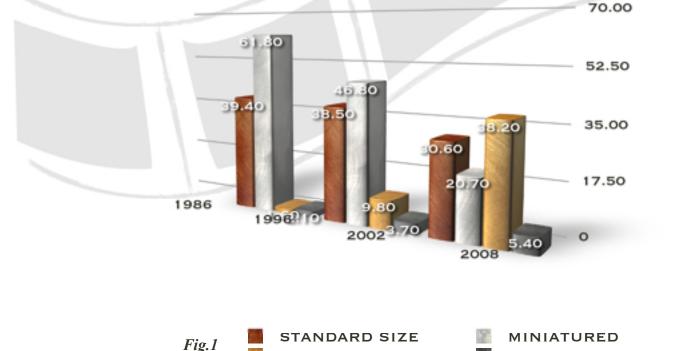
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如果用 Hype Cycle 的角度看自鎖式矯正裝置的發展過程,似乎也可以看到很微妙的類似之處。200 9,自鎖式矯正裝置的發展進入了新的戰國時 代。DamonQ, Smartclip SL3,In-Ovation,Quick 2.0 等等,宣稱帶來更精巧的設計,新一代的進化革命。然 而,這些來自廠商的廣告,卻讓我們臨床矯正醫師在選 擇矯正裝置時更加困惑了。本文由近十年已發表的文獻 回顧著手,試著了解目前自鎖式矯正裝置臨床表現是否 如同廣告宣稱那般優異。

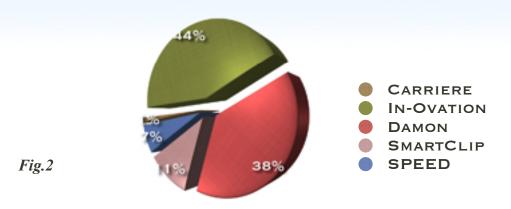
JCO 自 1986 年開始,每隔幾年就會做一次大規模 的問卷調查,以了解美國境內矯正界現況與趨勢1。在 2008 年的調查結果顯示, self-ligating bracket 的使用在 2002 年之後有大幅成長的趨勢。(Fig.1)目前使用的 自鎖式矯正装置以 In-Ovation, Damon, 與 Smartclip 這 幾個系統為主(Fig.2)

以 335 名美國矯正科住院醫師為研究對象的問卷 調查顯示,63.04%計畫在未來使用自鎖式矯正裝 置,92.03%計畫在未來使用 TADs,大部分醫師選擇特 定廠牌的矯正裝置的原因,還是因為在住院醫師受訓時 使用,同時也覺得還不錯²。

REDUCED FRICTION



SELF-LIGATING



臨床矯正醫師對於這可能是未來矯正治療裝置主流之一的潛在臨床優勢或是尚存的缺陷應該多一些了解 以下將逐項條列自鎖式矯正裝置之潛在臨床優勢3與已發表之臨床研究作一應證。

- 1. More secure and robust ligation
- 2. Reduced friction
- 3. Enhanced efficiency and ease of use
- 4. Reduced overall treatment time
- 5. Efficient alignment of severely irregular teeth
- 6. Improved patient comfort
- 7. Better plaque control
- 8. Reduced risk of operator injury including "puncture wounds"

1. More Secure and Robust Ligation -

在臨床上可以觀察到 O-ring 一類的矯正結紮用彈性線圈 (ligation elastomerics) 在口內結紮力量會隨著時間而大幅 衰減^{4,5}。因此,一般認為矯正結紮用彈性線圈較適合在矯正初期排列時使用,而不利於旋轉控制與扭矩表現 (rotational control and torque expression)。相對的,自鎖式矯正裝置除非裝置上的滑蓋(slide),金屬簧片(clip)失效 或是矯正裝置脱落,大致上都能提供較為強力而穩固的結紮。過去的Damon SL 容易有滑蓋鬆脱的問題,在後來的改 款已排除了這些問題⁶。

至於自鎖式矯正裝置是否較傳統矯正裝置容易鬆脱,Pandis等人比較傳統型矯正裝置(microarch, GAC)與 Damon 2 配合自酸蝕式光聚合黏著劑(transbond plus SEP與 transbond XT paste)與一般光聚合黏著劑(orthosolo 與 Enlight paste)於臨床使用之黏著失效比率。研究結果顯示各種矯正裝置與黏著劑的組合在黏著失效比率上並沒有顯著 差異7。在More secure and robust ligation這一點來說,自鎖式矯正裝置確實較有優勢。

2. Reduced Friction

儘管自鎖式矯正器的行銷相當強調低摩擦力,然而,在臨床上,摩擦力似乎不是阻礙滑動的主因⁸。實驗室研 究顯示 矯正線卡住(binding)矯正器的角落(在牙齒開始移動後很快就會發生)比之前想的要來得重要許多。摩擦力 這件事在臨床矯正上吸引了很多注意,因為廠商決定低摩擦是好的,也採用這個理念去行銷。臨床矯正醫師必須要 了解,有些時候,低摩擦是重要的-- 比如拔牙空間的關閉; 有些時候高摩擦是必須的--比如説 closing-loop mechanics, anchorage,還有2-couple system (torquing arch); 也有的時候,摩擦力並不特別重要,比如在 1-couple system (intrusion/extrusion arch)或是使用 cantilever 做阻生齒再置位⁸。

Fleming 整理了不同研究團隊對於自鎖式矯正裝置與傳統矯正裝置摩擦力之比較,大多數的研究顯示,自鎖式 矯正裝置提供最低的摩擦力⁹。Ehsani 對此主題做了一系統性回顧,顯示在一理想排列,沒有傾斜或是扭矩(tip or torque)的狀況下,使用自鎖式矯正裝置與細圓線的確可以得到較低的麼擦力。相對的,若是齒列不整程度較大, 同時有傾斜或是扭矩的狀況下,使用自鎖式矯正裝置與較粗的方線是否同樣可以得到較低的摩擦力則仍存在爭議 ¹⁰。此外,儘管,仍存在爭議,passive self-ligating appliance 的摩擦力大致上比 active self-ligating appliance 低。可以 肯定的是,隨著齒列不整程度的增加,摩擦力也隨之增加;隨著主線尺寸的增加,不管是自鎖式矯正裝置或是傳統 矯正裝置的摩擦力也會跟著增加¹⁰。在 Reduced friction 這一點來說,自鎖式矯正裝置確實較有優勢。儘管,目前有 限的臨床隨機試驗結果並不支持治療時間因自鎖式矯正器而縮短的主張(假設是因為低摩擦力)⁸。

No Study	. Systems Tested	Highest Friction II	Itermediate Friction	Lowest Friction
Shivapuja and Berger ¹⁶	7	Ceramic conventional*	SPEED	Edgelok
Voudouris ^{ar}	з	Sigma (American Orthodontics)	Interactwin (Ormoo)	Damon SL
Thomas et al. ³²	4	Twin ("A" Company)	Time	Damon
Kapur et al.ª×	2	MiniTwin ("A" Company)	_	Damon
Pizzoni et al. ^{su}	4	Conventional ("A" Compan	y) SPEED	Damon SL
Hain et al.23	4	Victory with elastomerics (3M Unitek)	SPEED	Victory with loose steel ligatures
Khambay et al. ^{ss}	4	Conventional* with elastomerics	Conventional* with wire ligatures	Damon 2
Griffiths et al.38	4	Inspire (Ormco) with SuperSlick module (TP Orthodontics)	Inspire brackets with elastomerics	Damon 2
Tecco et al.37	з	Victory	Damon 2	Time Plus (Adenta)
Henao and Kusy ^{as}	4	Mini Diamond (Ormoo)	Damon 2	In-Ovation

Table 1 引用自Self-ligating appliances: evolution or revolution? Fleming PS, et al J Clin Orthod. 2008 Nov;42(11):641-51

3. Enhanced Efficiency and Ease of Use -

Fleming 整理了不同研究團隊對於使用自鎖式矯正裝置能在臨床上節省多少時間,視情況與結紮方式而異,從 25 秒到 12 分鐘都有人提出^{9。}Turnbull 也同樣認為,在大部分的情況下,自鎖式矯正裝置可以提供較快的換線放線動作¹¹。在 Enhanced efficiency and ease of use 這一點來說,自鎖式矯正裝置確實較有優勢。

4. Reduced Overall Treatment Time —

宣稱自鎖式矯正裝置能夠縮短整體治療時間的依據,主要來自 Harradine,2001¹²與 Eberting,2001 的研究¹³。這兩個 Retrospective study 同樣顯示自鎖式矯正裝置(研究中採用Damon SL)與傳統矯正裝置相比,整體治療時間可以 縮短 4-6 個月,來診數減少 4-7 次^{12,13°}然而,Miles 認為,他個人使用傳統矯正裝置治療患者,平均時間為 15.4 個 月,標準差 4.2 個月,仍較上述使用自鎖式矯正裝置的治療時間短(分別是19和25個月)¹⁴。值得注意的是,上述 Harradine 與 Eberting 研究在治療時間和來診數之間也存在相當大差異。治療時間的縮短可能來自於潛在的樣本偏差 或是不同的力學機制,而不一定是不同的矯正裝置。

Miles 探討自鎖式矯正裝置是否能縮短拔牙案例的治療時間¹⁵。在此樣本數為 14 人的 split-mouth design 結果顯示,自鎖式矯正裝置在 en-masse space closure 與傳統矯正裝置相比較之下並無明顯差異。如果自鎖式矯正裝置能縮短 治療時間的話,也許不是在拔牙空間關閉的階段。

在研究室實驗結果顯示,自鎖式矯正裝置具有較低的摩擦力,然而,臨床研究顯示,低摩擦力似乎並不完全等 於較短的治療時間^{15,16,17}。在 Reduced overall treatment time 這一點來說,自鎖式矯正裝置是否存在優勢尚待更多隨機 臨床試驗證明。

	Harradine,2001		Eberting,2001	
	Month	Visits	Month	Visits
Damon	19.4	12.7	25	21
Conventional	23.5	16.5	31	28

Table. 2 Harradine與Eberting使用不同矯正裝置在治療時間與回診數之比較

5. Efficient Alignment of Severely Irregular Teeth -

除了快速關閉空間之外,我們可能期望自鎖式矯正裝置能較快速而有效率地排列整平較嚴重擁擠的齒列。Miles 以傳統 twin bracket (Victory,3M)與自鎖式矯正裝置 smartclip 做齒列初期整平效率的比較¹⁸。研究結果顯示,在10週的 實驗期間,因為自鎖式矯正裝置 Smartclip 與 0.014" CuNiTi 之間有 6.8°的旋轉空間 (rotational play),矯正線無法完全 發揮(fully engage),因此在齒列初期整平效率方面反而的比較不如傳統twin bracket (平均差異 0.7 mm)。Miles 再以 傳統 twin bracket (Victory MBT,3M)與自鎖式矯正裝置 Damon 2 做齒列初期整平效率的比較¹⁹。此研究採取 Splitmouth design,在齒列整平 10 週 (使用0.014" CuNiTi)與 20 週 (使用0.016"X0.025" CuNiTi)時做記錄。研究結果顯 示,傳統 twin bracket (Victory MBT,3M)在減小 irregularity index 上與自鎖式矯正裝置 Damon 2 相較之下有 0.2 mm 的 顯著差異。可能原因是 Damon 2 與 0.014" CuNiTi 及 0.016"X0.025" CuNiTi 之間分別存在 8.5° 與 1.8°的旋轉空間 (rotational play)所致。此研究所採取的實驗設計 Split-mouth design 可以去除實驗者之間新陳代謝活性的差異,然而 因為所採用的矯正裝置高度不同,可能也減少矯正線在 Damon 2 矯正器間自由滑動的程度。更多近期的臨床研究顕 示,自鎖式矯正裝置在齒列整平效率上表現並不會比傳統矯正裝置好20.21.22。Pandis 等人發現自鎖式矯正裝置與傳統矯 正裝置藉由相似的機制舒緩下顎門牙區的擁擠³⁰。在舒緩擁擠的過程中,下顎門牙前傾,牙弓會有些微擴張。齒列整 平效率與治療前凌亂程度有較大的相關性²¹。就以上研究結果顯示,如果自鎖式矯正裝置可能縮短治療時間的話,也 許不是發生在齒列初期整平的階段。在 Efficient alignment of severely irregular teeth 這一點來說,自鎖式矯正裝置是否 存在優勢尚待更多隨機臨床試驗證明。

6. Improved Patient Comfort -

自鎖式矯正裝置的廣告常宣稱能提供對病人而言較舒適的矯正過程--較低的摩擦力,較低的力量,將造成病患較低的不適感。 Miles在比較傳統 twin bracket (Victory MBT, 3M)與自鎖式矯正裝置 Damon 2 齒列初期整平效率時,請受試者記錄疼痛程度¹⁹。在 0.014"CuNiTi 裝置後第一二天,使用 Damon2 側明顯較不疼痛,然而在換置0.016"X0.025" CuNiTi 時,使用 Damon 2 側反而明顯較疼痛。一開始使用 Damon2 側較不痛原因可能是因為0.014" CuNiTi 並未完全表現的緣故,其後換置 0.016"X0.025" CuNiTi 時,因為初期整平尚未完全完成或是因為操作者的不熟練,反而造成患者較為疼痛。Scott 等人使用 VAS (Visual Analogue Scale 視覺類比量表)比較自鎖式 Damon3 矯正器與採用傳統結紮的 Synthesis 矯正器,發現兩者疼痛程度相當接近²³。另一研究顯示自鎖式Smartclip 矯正器與採用傳統結紮的 Victory 矯正器之間也無顯著差異,不過,在取下 0.019"X0.025" NiTi 主線與再置回的時候,使用自鎖式 Smartclip 矯正器會有較明顯的疼痛²⁴。Yamaguchi 等人以 Split-mouth design 檢驗成人矯正治療中牙齦溝液 (Gingival Crevicular Fluid)中致痛因子 substance P 的釋放量²⁵。研究結果顯示,Damon 矯正系統可抑制牙齦溝液中 substance P 的釋放量,因此可能可以減少因發炎或是矯正力量所造成的矯正疼痛。在 Improved patient comfort 這一點來說,自鎖式矯正裝置是否存在優勢尚待更多隨機臨床試驗證明。

7. Better Plaque Control -

我們通常認為使用彈性圈結紮會造成口腔內細菌滋生,利於牙菌斑堆積。Pellegrini 等人使用 ATP-driven bioluminescence assays 量化並以 Split-mouth design 比較自鎖式矯正裝置 In-Ovation R 與以彈性圈結紮的傳統矯正裝置 Mini-Ovation 牙菌斑生成堆積的狀況。研究結果顯示,使用自鎖式矯正裝置有助於減少細菌附著²⁶。然而,本實驗並 未與使用金屬結紮線之傳統矯正裝置相比較。此外,在矯正後期同時使用其他彈性輔助裝置 (power chain, elastics) 也許會減弱自鎖式矯正裝置在減少細菌附著上的優勢。相反的,另一近期研究顯示,矯正治療後唾液中 Streptococcus mutans 量與矯正裝置無顯著關係,與患者接受矯正治療前唾液中 Streptococcus mutans 量有關²⁷。在 Better plaque control 這一點來說,自鎖式矯正裝置是否存在優勢尚待更多隨機臨床試驗證明。

8. Reduced Risk of Operator Injury Including "Puncture Wounds" -

很不巧的,目前並無相關文獻證實這潛在優勢。除了上述已探討自鎖式矯正裝置可能具有的潛在優勢以外,臨床 矯正醫師相當在意矯正終了時上顎前牙的位置-- anterior torque。因為 anterior torque 過多或是不足會影響微笑曲線,前 牙導引(anterior guidance)還有一級咬合關係(solid class I occlusion)的建立。並沒有已發表的文獻證實自鎖式矯正裝 置在空間關閉與扭矩表現(torque expression)同樣有效率。因為就力學機制的觀點來說,滑動機制需要低摩擦力,而 扭矩表現需要藉由矯正線與矯正器之間的高摩擦達成。一實驗室研究指出主動式自鎖式矯正裝置(active self-ligating bracket, In-Ovation/Speed)能比被動式自鎖式矯正裝置(passive self-ligating bracket, Damon 2/ Smartclip)更有效率地表 現扭矩²⁸。要達到臨床上可用的扭矩(5-20 Nmm),主動式自鎖式矯正裝置需要15°的 wire torsion 而被動式自鎖式矯正 裝置需要 22.5°(比較一下,Roth prescription U1 為12°, Bioprogressive prescription U1 為22°)。Pandis 等人的臨床研 究顯示自鎖式矯正裝置在拔牙與非拔牙病例似乎都能與傳統矯正裝置一般有效的提供足夠的上顎前牙扭矩²⁹。雖然沒 有在實驗室研究得到證實,Reverse curve 性質的矯正線材在扭矩建立的階段應該是有幫助的。至今(2009-07)為止, 已發表的前瞻性臨床試驗(prospective clinical trials)探討了自鎖式矯正裝置在 Enhanced efficiency and ease of use / alignment efficiency during the initial stage of treatment / pain / plaque control /Torque expression 這幾個方面的表現。大部 分的研究結果都無法證實自鎖式矯正裝置相對於傳統矯正裝置的潛在優勢。然而,雖然目前的臨床研究結果無法證實 自鎖式矯正裝置較具優勢,但也並不能直接斷言自鎖式矯正裝置是無效的裝置。



結語

回顧這數十年來齒顎矯正治療理念的改變,似乎一直在 extraction vs. non-extraction, expansion vs. non-expansion 之間擺盪。各派宗師論戰不已,數十年來也鮮有一致的共識。Zachrisson 對於面對新的高科技矯正裝置---自鎖式矯正裝置與超彈性矯正線材時應有的態度,提出了語重心長的建議,回歸醫者最基本的治療理念 "Clinical excellence ultimately is derived from a personal commitment to do what is right"³⁰。在臨床上我們應該尊重病患治療前的犬齒間距(3-3distance)與合理正常的下顎牙弓形態(reasonably normal mandibular arch form),而不是一味的進行牙弓擴大。拔牙與否,應該基於診斷而非基於行銷考量³¹。最後再以 Hypecycle 的角度來看自鎖式矯正裝置。目前,自鎖式矯正裝置應該還在 Hype cycle 的早期階段---儘管缺乏實證或是僅有相當有限的證據支持--廠商或是大眾仍對此產品寄與厚望。以我有限的臨床使用經驗來說,我會認為再好的矯正裝置都有人會用不順手。再傳統的矯正裝置,也有的大師數十年如一日的使用著。我們很幸運的有相當多專家前輩願意無私的分享他們可貴的臨床經驗,同時也很容易可以取得已發表的臨床研究做驗證。讓自己保持在不斷學習的狀態,也許是掌握矯正精髓的唯一法門。



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小子 非学 小您一定要讀!! 以下是AJODO副主編Alex Jacobson對此書之推薦:It is definitely recommended reading!

REVIEWS AND ABSTRACTS

Book reviews and article abstracts

Alex Jacobson, Associate Editor Birmingham, Ala

申 閱讀

BOOK REVIEW

Creative orthodontics: Blending the Damon system and TADs to manage difficult malocclusions

By John Jin-Jong Lin Yong Chien Company, Taiwan (yonchieh@seed.net.tw); 2007; 324 pages; \$185

Reviewed by Alex Jacobson

The introductory chapter is devoted to the differential diagnosis and management of anterior crossbites and commonly used orthopedic appliances for the correction of Class II and Class III malocclusions by taking advantage of the growth period to obtain adequate dentoal/veolar change and proper occlusion. Emphasized is the orthodontic effect of treatment rather than the effect of orthopedics, which, observed in the long term, is minimal or even none. For the differential diagnosis and management of anterior crossbites, the author applies a 3-ring diagnosis system that considers the profile in centric occlusion, the carine and first molar occlusal shift. In the section that deals with the management of anterior crossbite, reasons are provided for withholding correction of the anterior crossbite until the eruption of the second molars; these, however, are the rare exceptions. Illustrated at the end of the chapter are 14 case reports.

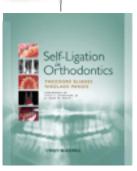
The second chapter, which describes the Damon system, begins by providing the history, the development, and a comparison of the various self-ligating appliances. Shown and described are the characteristics, biomechanics, tooth movements, indications for use and sequences, mechanics, treatment procedures, conventional protocol, and retention methods used in the Damon system. Various cases using this system are displayed at the end of the chapter-17 in all. Subtly unique is the author's differential diagnostic procedure in the management of anterior crossbite in which the canine and first molar classification is used (part of the 3-ring diagnosis) in lieu of Angle's traditional classification method. The author enthusiastically endorses the Damon system of orthodontic treatment. The advantages of combining miniscrews and bite-jumping appliances with the Damon system are discussed. The text contains numerous color photographs and sequences of magnificently treated patients.

In all, this is an excellent instructive and reference text for postdoctoral orthodortic students and specialist clinical orthedontists. It is definitely recommended reading.

Am J Orthod Deutofacial Orthop 2008;133:923 0889-5406/534.00

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Self-Ligation in Orthodontics Theodore Eliades (Editor), Nikolaos Pandis (Editor) ISBN: 978-1-4051-8190-7Hardcover 208 pages June 2009, Wiley-Blackwell Wiley List Price: US \$159.99 2009年6月最新出版Self-ligating in Orthodontics,是目前最新而有系統性的 文獻回顧專書,推薦給看了本文還覺得 意猶未盡的客官們,請洽日毅書局 02-23316788

Modern Orthodontic Office Design ~ Part I



子醫師,是一群認真的醫師。在台灣幾乎每個週末都有牙醫相關的演講、討論會,擠滿為了 進專業知識與技術,提升工作的能力與效率的認真醫師。然而,工作效率的提升其實還 包含了許多內容,譬如治療流程、病人管理、工作動線...等等;簡單地説就是要在好的診 所環境中使用有效率的管理方法提供精良的治療技術,如此方能帶來醫師與病患雙贏的結
Dr. Warren Hamula 在美國設計監造超過百家矯正診所,更是第一位將診所設計理念集 結成書開班授課的牙醫師。從本期 NTO 起我們將整理書中的13個重點與您分



IDEAL FLOOR PLAN

理想空間規劃的最重要原則就是要符合醫師和助 理的工作型態。也就是説醫師本身要先清楚自己和助 理的工作習慣,比如説是固定一位助理跟診呢?還是 兩位?還是只要流動助理即可?因為這將會牽涉到診 療椅間距的考量;又以助理消毒器械舉例,是診與診 中間一次進消?還是在開診中間就需要進消?這個模 式也會決定消毒室與診療區的空間關係。所以,看診 模式先決定之後,依照需求由最重要的診療區開始規 劃,再來是鄰近的消毒室、X光室、諮詢室...等,最後 才是掛號櫃台與候診區的考慮。如此一來方能設計出 最適合自己的空間規劃。

OPEN STYLE OFFICE

所謂 Open bay 的診間就是相對於一張治療椅就獨 立一個隔間的設計(Fig.1)。開放式診間的好處有 三:一、方便與家長溝通。不論是説明療程、解答家 長的疑問...等都能快速地當面溝通。二、提高信任 感。家長很清楚地看見所有發生的事,包含助理照 相,指導衛教等,愈透明愈沒有爭議。三、減少成 本。獨立式隔間的花費遠高於開放式診間,因為不只 裝潢上成本的增加,所有設備如紫外線消毒箱等也無 法共用,需要每間都備一套,大大提高成本;另外醫 師跳台的時間也增加了(Fig.2)。



Fig. 1 Open Style Office



Fig. 2 Enhancement of Trusting Atmosphere



安徒生兒童牙醫診所負責人 貝多芬矯正課程講師

徐玉玲 醫師

談到開放式診間還要想到中央供應的位置,可分為 Rear Island 後方供應(Fig. 3)及 Central Island 中島供應 (Fig. 4)。這個位置決定了助理整天工作中最常發生的 動線。

ON DECK CONCEPT

源自棒球運動中打者等待上場打擊的概念,應用在 患者量大的矯正診所中,就是讓病患就近等候縮短上下 診療椅的時間。如此不但可以提高看診效率,也等於增 加了候診空間,減少人多壅塞的情況,同時也方便醫師 助理掌控全場,不致疏忽在角落等待的病患(Fig.5)。

DELIVERY SYSTEM

從1950年代開始 Hoffman 等人開始研究牙科工作檯 面與醫師位置之間的關係(Time and Motion Study),工 作檯面在牙醫師幾點鐘的方向拿取器械才會順手?如何 才能夠讓牙醫師的動作最小?節省最多時間?造成身體 最少的疲勞?這個研究的重要性可從1994年 JCO 的封面 上窺知(Fig. 6)。一般牙科的診療椅大部份是採用 Side Delivery System,意即醫師工作台面來自診療椅延伸的手 臂,它的缺點在於:工作檯面較小、儲藏空間不足,延 伸的檯面阻礙動線以及暴露不易清潔的管線(Fig. 7)。 而在矯正治療中由於需要使用快慢速手機的機會較小且 使用器械較多,所以建議採用 Rear Delivery System。1994年JCO 的封面故事就是在説明原始 Rear



Delivery System 在醫師六點鐘方 向應該調整至八點鐘方向會使操 作更加便利。這個系統優點在 於:工作檯面較大,儲藏空間較 ,上下診療椅不易受干擾。經 過長時間的驗證,在醫師二點鐘 方向加入活動櫃,可以合併這兩 個系統的優點(Fig.8)。





Fig. 3 Rear Island

Fig. 4 Central Island



Fig. 5 On Deck Concept



Fig. 7 Side Delivery



Fig. 8 Rear Delivery

Fig. 6 Cover of JCO 1994

Interdisciplinary Treatment (Part II)

- Summary of Dr. Kokich's farewell lecture in Taiwan -

在 NTO 15 的第 36 ~ 41 頁我們已經先談過 Dr. Kokich 對 Interdiscipline 的定義及五項 interdisciplinary treatment planning 的 guidelines 中的第一項 – Generate "realistic" occlusal objectives。我們將在本篇 Part II 繼續探討第二及第三項 guidelines,也就是: Create the vision, Establish the sequences of treatment。並在 Part III 探討第四項 – Determine the responsibility of periodontal problems, Part IV 則探討第五項 – Position teeth to enhance future restorations。由於篇幅問題,我們將先刊出 Part IV,並在下一期 NTO 刊登頁數較多的 Part III 牙周病相關部分。

Create the vision

對於一些齒列有缺損,或伴隨有牙周問題的成人 患者,我們在設定治療目標的時候,往往不能像齒列完 整且牙周健康的青少年患者一樣達到所謂的"Idealistic occlusal objectives",而需依患者的口腔狀況,以" Realistic occlusal objectives"為治療目標。

而我們如何得知怎樣的治療結果對患者而言是妥協下的、可行的理想咬合呢?整個治療團隊在設計治療計畫的時候,必須要有人"create the vision"。如此一來,整個團隊才有個一致的方向得以依循。而治療團隊中,矯正醫師是最佳人選!面對十分擁擠的齒列, general dentist 對治療結果的預想往往沒有矯正醫師來 得敏鋭,畢竟對矯正醫師來說,排牙齒是每天的例行工 作,矯正醫師可以輕易預想很 crowding 齒列的治療結 果。

但若是一個較複雜的病例 (Fig. 1)^{1,2},患者有多顆 缺牙, Dr. Kokich 請問台下所有矯正醫師,你們可以" visualize "這樣的病例矯正完成後會是怎樣的治療結果 呢?Dr. Kokich 希望所有台下的矯正醫師回答的答案是 "NO"!!如果沒有事先跟 Restorative dentist 討論,矯正 醫師是無法預想這樣的病例的治療結果的!矯正醫師絕 對不是最後決定 restorative decision 的人!!這樣的 case 如果不先經過 wax-up 就想要治療,簡直是一種自 殺的行為!針對這樣的患者如何訂定治療計畫呢?

- 首先, orthodontist 必須先跟 restorative dentist 討論 可行的治療目標;
- 2. Orthodontist 先製做出 diagnostic wax-up model;
- Orthodontist、Restorative dentist、患者及家長再針對 final treatment planning 討論;
- 將 Diagnostic wax-up 複製三套,這樣矯正醫師、假 牙醫師、及患者三方對治療目標都有所依循,也就 是 Dr. Kokich 所説的: Create the vision。

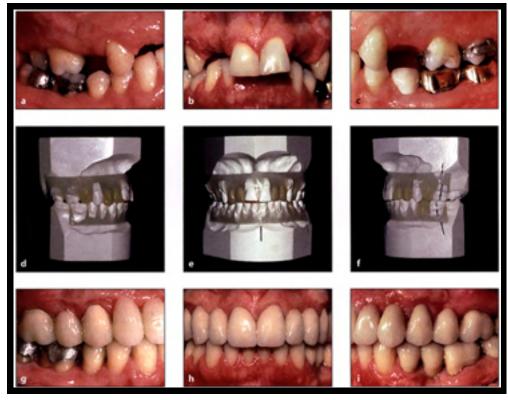


Fig. 1 (Case from Dr. Kokich^{1,2})

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Establish the sequence of treatment

經過確立 realistic occlusal objectives ,以"diagnostic wax-up"來 create the vision 接下來就是establish the sequence of treatment。牽涉到跨科合作的複雜 case,各專科醫師應該在何時做什麼處置,為確保治療成果及療程流暢有效率,建立先後順序很重要!

Dr. Kokich 舉出他太太的表妹為例。這位芳齡 14的 年輕患者因為滑水意外外傷喪失了 #11~ #14 四顆牙及附 近的齒槽骨,戴著 RPD,花樣年華的少女失去了美麗的 笑容與自信。17 歲時,少女的父母親很心疼失去自信變 得封閉的女兒,向 Dr. Kokich 尋求建議與治療,Dr. Kokich 基於親情與名譽,召集治療團隊的各科菁英一起 商討對策。面對 multiple teeth loss 患者,首先要決定的 是將來缺牙區將以何種方式做復形,因此, "Restorative dentist"是 treatment sequence 中,第一個做決定的人!

Dr. Kokich 先問 Prostho. 醫師: Frank, what do you need to restore this patient? Prostho. 醫師回答是: Implant supported bridge!因此,團隊就以此"Restorative needs"為主軸來做討論,決定"Who did what, when, how"。邏輯討論流程圖如下: (Fig. 2)



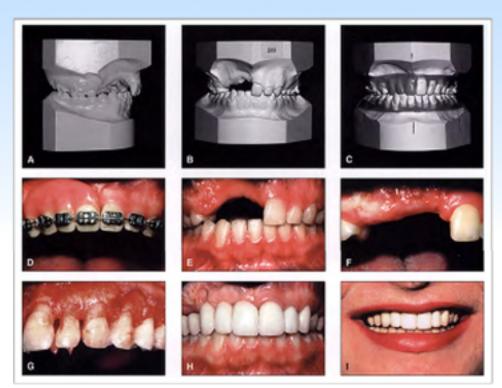


Fig. 3 (Case from Dr. Kokich²)

這麼多工作要做,決定何時由誰做什麼處置的先後順序 很重要。決定順序之後,每一位治療團隊中的醫師及患 者都應該有一份治療流程的書面記錄。如此一來相關人 員都可以掌握流程,適時介入開始自己的部份,患者看 著自己的治療上軌道地日益接近目標也會有信心及安全 感。而經由整個團隊整合討論後的 chart flow 我們可以看 出,整個 team 一起討論時,各領域的專科醫師可以知道

自己的 limitation,例如 restorative dentist 最後就遷就患 者的 atrophic edentulous ridge,放棄 implant-supported bridge 而改做 cross-arch 的conventional bridge (Fig. 3), Dr. Kokich 針對這一點有另外提到,如果以現今 implant dentistry 的技術而言,這個患者應該還是可以用 implant-supported bridge 來復形。患者最後的治療流程如 下: (Fig. 4)

Treatment sequence	Practitioner	
1. Create the vision(wax-up)	Group	
2. Separate consultation	Group,patient & parents	
3. Align the teeth	Orthodontist	
4. Segmental surgery	Oral surgeon	
5. Finish the orthodontics	Orthodontist	
6. Augment the ridge	Periodontist	
7. Orthodontic retention	Orthodontist	
8. Crown lengthening	Periodontist	
9. Provisionals	Restorative dentist	
10. Final restoration	Restorative dentist	

Fig. 4

Reference

- V. G. Kokich Adult Orthodontics in the 21st Century : Guidelines for Achieving Successful Results. Papers & Abstracts : 6th International Orthodontic Congress, 2005. World Champion Lecture North America
- 2. V. G. Kokich Interrelationship of Orthodontics with Periodontics & Restorative Dentistry. *Biomechanics & Esthetic Strategies in Clinical Orthodontics*

Sth 貝多芬元旦高球邀請賽

Beethoven Golf Invitational

- ♀ 時間:2010 元旦(四)7:00 am 準時開球
- 地點:東方日星高爾夫球場(035762200)
 新竹縣寶山鄉深井村9鄰寶新路676號
- ♀ 費用:

每人全部費用 2200 元整

(含球車費、果嶺費、桿弟費、午餐、賽中點心水果)

- 報名方式:
 - 1. 直接向金牛頓(035735676)報名,歡迎組隊參加;
 - 2. 或請傳真03-573-6777, 註明: (1)姓名(2)連絡電話(3)組名。

12月16日前截止報名,名額限40組。聯絡人:黃思涵小姐 03-5735676。 網址:<u>www.beethoven-teeth.com.tw</u> 歡迎12月16日後上網查詢編組狀況。

本活動採預約報名方式, 恕不接受現場報名, 敬請見諒!

午餐酒會 於球場二樓舉行 11:40 am 開席頒獎

Interdisciplinary Treatment (Part IV)

Position Teeth to Enhance Future Restoration

Summary of Dr. Kokich's farewell lecture in Taiwan —

Restorative Dentistry 方面, Dr. Kokich 將跟矯正相關的 Cases, 分成 *canine substitution、implant patient、incisor abrasion* 三部來探討。

Substitution Case

Dr. Kokoich 舉出三個 maxillary canine and lateral incisor substitution cases,來介紹思考模式及考量分析方式,我們提出其中的兩個 case 來討論。(Kokich & Crabill 2006)

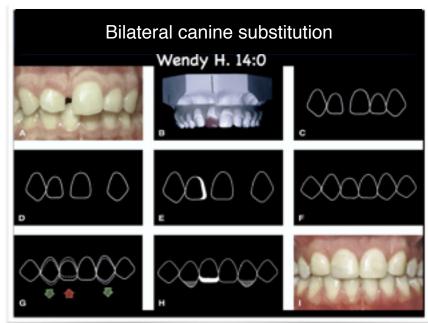
Case 1

患者是一位14歲的女生,右上 central incisor missing 很多年,口內狀況為 Bilateral Class II canine and molar relationship^{1.} (Fig. 1)^{1。}

Treatment alternatives

- 1. Mandible sagittal osteotomy (surgery for Class II correction) => 不可行,因 profile 很好
- 2. Extract upper premolars (create #11 space and implant)
- 3. Extract one premolars (R't side substitution)
- 4. Extract upper left lateral incisor (Bilateral canine substitution)

Fig. 1 (A) 口內正面觀, 可見 #11 missing。(B) Wax-up 決定拔除 #22 做 bilateral canine substution。模型中間正上 方鉛筆 mark 為原來偏左的中線, wax-up 後將中線改正。(C)拔牙前前牙的模擬示 意圖。(D)拔除左上側門牙。(E)矯正前 先將右上側門牙以 compostie resin 復形成 跟左上正中門齒一樣大小。(F) 治療完 成的模擬圖,除了 #12 取代 #11, #13 取 代#12,及#23取代#22,特別要注意的 是 level of gingival margin,及牙齒的外 形。(G) 利用改變牙齒的垂直關係,改 變 gingival margin relationship。將取代 lateral incisor 的 canine extrusion,取代 central incisor 的 lateral incisor 做 intrusion, 改變 gingival margin relationship。(H) 最後再 equilibrate the canine, 減少 canine長度, 增加 lateral incisor 的長度,使得看起來結果更 reasonable ° (I) Final result ° (Kokich V.G. et al, 2006¹)







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Fig. 2 (A) Pano 可見 #11 & #21 macrodontia;(B) #21 erupt 後才發現 morphology 異常;(C)(D)因患者年紀很 小,故決定拔除 #11 & #21 as soon as possible, 讓 lateral inciosrs 可以自己 mesial drift,拔除的 #11 為 12mm、#21 為 15 mm 寬;(E)(F)(G)拔牙後為了讓 lateral incisors 可以自己 mesial drift,患者沒有配戴 任何空間維持器,到患者 9 歲時,lateral inciosrs 已經從原來相距 25 mm 自動 drfit 到 相距 8 mm 的距離,此時將 lateral inciosrs 用 composite resin 復形;(H) 患者17 歲時對自 己的外觀感到不滿意,故先將 lateral inciors 做provisional crown 再開始 ortho. tx 將空間關 閉,再做 gingival surgery 使 gingival margin harmony;(I) Ortho 治療結束後,上顎的 lateral inciosrs 及 canines 以porcelain crown 復 形。這個治療計畫成功的維持了 alveolar ridge 寬度,並達到理想的咬合與美觀的治療 結果。(Kokich V.G. et al, 2006 1)

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贝多芬矯正課程講師

Substitution Case

Case 2

患者是七歲七個月大的小男孩,從 pano 可見他有兩顆 macrodontia 的上顎正中門齒,但一直到 #21 長出來才發現。(Fig. 2)¹

Treatment alternatives

- 1. Open space for centrals
- 2. Open space for laterals
- 3. Extract upper premolars(create space for centrals or laterals)
- 4. Extract lower premolars and canine/lateral substitution

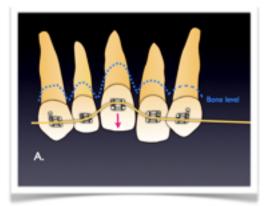
前兩項 treatment alternatives 皆會導致 incisor proclination 的結果;而拔除上顎 premolars 的治療計畫 對患者而言 trauma 太大,將來還需要 implant 復形;因此最後選擇第四個治療計畫。

Implant Patient

當遇到 root structure 不好,或是 perio. destruction 導致 bone level 太低,或是 endo. failure,這類患者若拔牙後要以 implant復形,拔牙後通常會導致 implant site 的 severe bone resorption 而使得植牙手術變得複雜而困難,這時若利用矯正的方式來做 controlled extraction,順便將 bone level 帶下來,將能 create 比較好的 implant site。但這樣的方法並不是每一個 case 都會成功!!還是有它的 indication :

1. Gingival levels 2. Labial bone level 3. Tooth inclination

首先要注意的是矯正器 bonding 的位置,不應該為了extrusion 而將位置提高到太靠近 gingival margin,若加上使用 flexible NiTi archwire,這樣會無法控制 extract 的速度,而使得速度過快,以致於無法達到預期的效果。應該將 bracket bonding 在同一 level,再利用 wire bending,使用 round archwire (這樣才不會產生不必要的 torque)做 steps in the wire,控制 extract 的速率,才能達到改善 bone level 的目的,增加 vertical 方向的 bone。(Fig. 3, Fig. 4, Fig. 5)



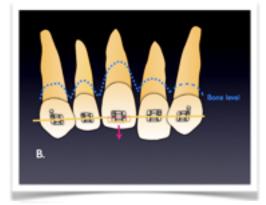


Fig. 3 (A) 直接改變 bracket level 用 NiTi wire 做 extrusion 會導致 extrusion 速度太快,沒有辦法長出很 dense 的 bone;(B) 利用.018 SS wire 做 step bend 來 extrusion,理想速度是 0.5 mm/month,這樣子植牙手術時將牙齒 extraction 可以看到 socket 底部是 shinny solid bone。

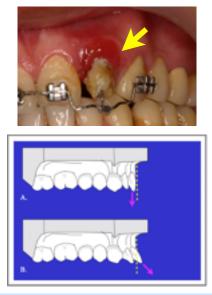


Fig. 4 在做 controlled extraction 時若出現 red collar 表示 extrusion 的 速度過快,這是 inner side 的 long junctional epithelium 被拉扯往外翻 所導致的 non-keratinized area,此時應該將力量放掉,讓牙齒縮回去 再慢慢 extrusion。Dr. Kokich 認為這樣的方式應該只適用於合作度好 的患者,因為這樣的治療會耗費較長的時間。

Fig. 5 Tooth inclination 也是決定 orthodontic implant site development 會不會成功的重要因素。表示牙齒 extrusion 時往下拉路徑的粉紅色 箭頭平行於前牙的 bone (黃色虛線), controlled extraction 才會成 功;若牙齒的角度很 proclined (B), 那麼我們往 extrusion 時的方向 將遠離 bone, 無法 induce bone growth。

Incisor Abrasion

Crown length的重要性²(Kokich, et al. 2006)

Washington university 曾做過 study,利用軟體處理之後的照片,來研究一般人對於 unequal crown length 的感知 的極限,軟體藉由修改左上 central incisor 的 gingival margin 高度,但是不改變 incisal edge 的位置,來改變 crown 的 長度。研究結果顯示,一般人要到差距 1.5mm 以上時 (Fig. 6, D)²,才會感覺認知到 asymmetry。所以遇到 asymmetry 的情形,要仔細觀察,善用各種條件來達到美觀的要求。

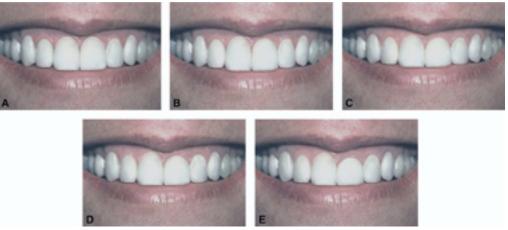


Fig. 6 兩顆 central incisor 的 gingival margin 高度,一般人要到 差距 1.5mm 以上時 (D圖),才會感覺認知到 asymmetry。(Kokich V.O. et al, 2006²)

以下我們來看一個 Dr. Kokich 所舉出的案例³。患者是 36 歲 7 個月的女性,主訴不喜歡她的前牙,希望前牙看 起來美觀一點 (Fig. 7)³。由口內狀況可見,患者前牙不美觀的主因是 Unequal crown length, Dr. Kokich 再此特別提 醒矯正醫師,如果我們一直讓患者躺著、從上方去看患者,那麼我們永遠無法發現患者的 unequal crown length !! 一 定要讓患者站起來,我們從正面去看,才會發現這個問題!

Fig. 7(A)(B) 患者的 frontal view 可見右上前牙的 crown length 明顯比左上前牙短,並且因為缺牙的關係,上顎中線偏向右側;(C)從咬合面可見又上前牙的 incisal edge 厚度明顯比左側厚,表示 incisal edge 的 "lingual & labial" surfaces 皆有 wearing 現象, 由此可見患者有 severe prtotrusive attrition;(D) 患者原本的矯正醫師卻沒有診斷出 前牙 abrasion 而根據 incisal edge 來 bracketing, 導致前牙 align 之後出現明顯的 gingival margin discrepancy。(Kokich V.G. et al, 2005 ³)



診斷 Unequal Crown Length 應如何治療,應該從四個要素著手

1. Lip level 2. Sulcus depth 3. Width to length proportion 4. Amount of wear

Lip level

Lip level 如果很低,即使不處理也看不到,就沒有處 理的迫切必要。但是如果患者為 high lip line,笑起來看的 到前牙,會影響美觀及對稱性,就需要處理。

Probing depth and bone level

首先要評估牙周狀態的條件,才知道究竟是 Orthodontist 要用 intrusion/extrusion,還是 Perio. doctor 要 用牙周手術來解決這個問題。先確定 sulcus depth, bone level 正常,再確定 CEJ 的相關位置,就可以決定要用何 種牙周手術 (Crown lengthening/ Gingival surgery/ Gingivalplasty) 來處理這種不對稱的問題 (Fig. 8)³。

Width to length proportion

通常width to length proportion沒有絕對的標準,Dr. Kokich覺得通常合理的標準約在67%~80%左右,以上顎 central incisor為例,如果是 8mm寬,長度落在 12mm ~ 10mm 通常都是合理的。以這個患者為例,#11 的寬長比為 86%,#21的寬長比為 73%,顯示 #11 的 crown length 明顯不足。

Amount of wear

通常可以在 labial side 見到磨耗的痕跡,或是 dentin 外露,就有可能是特殊的磨耗導致的 unequal crown length,就需要考慮 wear 的因素。這個患者就是 severe



Fig. 8 (A) 首先拆掉患者原來的 brackets; (B)(C) Bone sounding 後發現兩側門牙的 biologic width 為 3mm,但 CEJ = bone level (30歲左右的患者 bone level 應低於 CEJ 2 mm),表示這個患者有 "Altered active eruption" 的問題,應該用 perio. surgery 來解決 gingival margin的問題; (D)(E) Flap 翻開後,將 bone trimming 到 CEJ 以下 2mm; (F) (G) 左側前牙也施予同樣術式; (H) 將flap做apically repositioned,使 gingival margin 在位於這些牙齒 labial bone level 的 coronal 3mm 處。(Kokich V.G. et al, 2005³)

protrusive attrition 所導致的 incisor abrasion [。]治療 unequal crown length 的 Options 有以下三種 :1. Crown lengthening 2. Tooth extrusion 3. Tooth intrusion.

在這個case,就是選擇右側前牙intrusion,等到改善 gingival line 的對稱性及關係後,再請 restorative dentistry 依照合理的 width to length proportion 及參考左側的牙齒,暫時以 composite resin 復形,再來做最後的 detailing。要注意的是,應該要 over intrusion一些,而且 intrusion 後至少需 maintain 六個月,才能讓 PDL remodeling, stability 才會好。(Fig. 9)³



Fig. 9 (A) Gingival surgery 後一週可見左右兩 側的 crown length 還是不等長,顯示不等長的 原因還是有一部分來自於 incisal abrasion; (B)(C)因此我們重新放置矯正器將 #11, #12 做 intrusion, 直到 gingival margin 的 level 等 高 (右側甚至已經 over -intrusion);(D) (E) 再請 restorative doctor 將 wearing 的 incisal edge restored,重新放置矯正器做 final detailing 完成矯正治療;(F)矯正治療完成一 年後用 porcelain laminate restoration 完成前牙 復形。(Kokich V.G. et al, 2005³)



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Reference

- 1. Kokich V.G. et al, Managing the patient with missing or malformed maxillary central incisors. *Am J Orthod Dentofacial Orthop* **129**: S55-63, 2006.
- Kokich V.O. et al, Perceptions of dental professionals and laypersons to altered dental esthetics: Asymmetric and symmetric situations. Am J Orthod Dentofacial Orthop 130: 141-151, 2006
- 3. Kokich V.G. et al, Inheriting the unhappy patient: An interdisciplinary case report. Adv Esthet and Interdisc Dent 1: 12-22, 2005

Implant Revolution

Summary of Dr. Kokich's Farewell Lecture in Taiwan —

wplant 最早被提出是在 1950 年代,當時是使用認為有生物相容性的 Vitallium screws 來取代 lateral incisor,但 是失敗率相當高。不久後的 1960 年代,Dr. Linkow 發明了 bladevent implant。1968 年他在 Dental Concepts¹ 發 表了 Blade vent endosseous implant,但這種 implant 因為手術範圍很大,若失敗則易造成大範圍骨髓炎。因此,在當時 對 Dr. Linkow 的負面評價很多,很多人認為他根本就是一個江湖郎中(Charlatan),被當時的牙醫界所排擠。但Dr. Linkow 並不因此而退縮,他在 1966~2004 年間,總共發表了 93 篇文章,Dr. Kokich 認為他是一個勇敢而值得贊許的 人—"He is not afraid to try anything"!! 在 1974 年 Journal of Prosthodontics 的一篇社論中,也認為當初對待他的方式是 一種專業的歧視,因而阻礙了 implant 的發展。 終於,在 1981 年,一篇文章²改變了 implant dentistry。Dr.Bränemark 這位骨科醫師將 Titanium screw 植入兔子的長骨中,意外的發現 titanium 和 bone 會產生 osteointegration,而他的鄰居 又恰巧是一位 prosthodontist,兩人在院子裡的交談意外的改變了 implant dentistry 的歷史。事實上,Dr. Bränemark 也 是從 1960 年代開始發展 implant,而從他在 1981 年發表 titanium implant 的第一篇文章以來,到 2009 年為止,相關的 文獻共有 14190 篇被發表 !!

那麼,在矯正的範疇中, implant 所扮演的角色是什麼呢? Dr. Kokich 針對 single-tooth implant 在 congenital tooth missing 復形時所扮演的角色 — 其中又以 missing maxillary lateral incisors 以及 mandibular second premolars 最為常見,因此 Dr. Kokich 就針對這兩類病例來提出討論。而其中因為上顎側門牙不管對 surgeon、orthodontist、或 restorative dentist 而言,在美觀因素上都是很大的挑戰³,所以 Dr. Kokich 就先討論缺少上顎側門牙的情況。

Six Questions of Maxillary Lateral Incisors Implants : Overcoming the Esthetic Challeng

How much space is needed for single tooth implants?

若只有單側側門牙缺失,通常應以對側 natural lateral 的大小來參考 — Always match the lateral of natural side !! 但一般若只有單側側門牙缺失,對側的 lateral 通常會是 peg lateral。因此若是只靠量測對側 natural lateral 的大小不 一定可靠。若病人是兩側 lateral 均缺失, general dentist 要如何要求矯正醫師去創造多少空間來 restore lateral?這 要考慮到兩點:

- 站在 GP 醫師的立場需要考慮 space across the tooth;
- 站在 surgeon 的立場則須考慮 space across the roots。

首先談到 space across the tooth,必須同時考慮到 esthetics 以及 occlusion。以 esthetic 方面來說,指的是 central、lateral、canine 之間美觀的關連性,長久以來,我們依循的是被稱作" Golden "proportion 的黃金比例。 Classic golden proportion 是 central: lateral: canine = 1.618:1:0.618 (Fig.1a)。但是事實上 canine 的寬度不可能 是 lateral 的 61.8%。所以" Golden " proportion 的寬度指的是" perceived " width,而我們一般量 crown 的寬度是量" absolute " width。那麼,哪裡可以找到" Evidence " 來支持以上的 data 呢? 在 1999 年4 針對男性和女性前牙牙冠 比率的調查中發現,男性平均牙冠寬度 central 是 8.59 mm, lateral 是 6.54 mm,而 canine 是 7.64 mm; 女性平均牙冠



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寬度 central 是 8.06 mm, lateral 是 6.13 mm, 而 canine 是 7.15 mm。因此 lateral 和 central 的比例關係的平均值約 是 75%。在臨床上, 67%~75% 的比例都是可以被接受的。所以 general dentist 要轉診兩側 lateral missing 的 病人給矯正醫師時,第一件要做的事是去量測 central 的寬度。而 central 的寬度約是 8~10 mm, 換言之 lateral 的大小就約是 5.5~7.5 mm (Fig.1b)。因此,如何讓 missing lateral incisors 復形達到最美觀的復形結果,最 重要的原則就是要掌握 central 和 lateral 的相對比例 (related width)!!

再來談到 occlusion 方面。如果患者的咬合很好,但植入 implant 所需空間不足,最簡單的解決方式就是 Slenderizing !! Dr. Kokich 在此舉出一個 20 年前接受過矯正治療的上顎雙側側門齒先天缺牙患者,他的 occlusion 是 Class I with normal overjet、overbite, central incisor 的寬度是 8 mm,預留給 lateral incisor 的植 牙空間則是 5 mm。若 surgeon 要在 5 mm 的空間植牙,就必須使用最細的 implant (直徑為 3.2 mm),而植體 和兩側鄰牙距離只有 0.9 mm。事實上植體和兩側鄰牙距離至少需要有1.4mm。因此解決方式就是要做 slenderizing,但 slenderizing 會導致牙齒之間的 contact area 變長, contact area 變長則 fill in interdental area的 tissue 會很窄,組織愈窄則 papilla 就會愈短。所以矯正醫師若只留 5 mm 給手術醫師就會造成美觀上很大的問 題。

一般此時會選擇修磨牙齒,若將 central incisor 及 canine mesial & distal 各修 磨 1/4 mm,側門牙區就可以 有 6 mm 的空間,對 surgeon 而言這似乎是一個好消息,因為 如此一來 implant 距離兩側 natural tooth 就會有 (6-3.2)/2=1.4mm,但這會衍生另一個問題 !! 在正常情況下,牙齒之間要有美觀的 papilla,首先要有正常的 bone height,再來則要有正常的 tooth contour。若 tooth contour 不好就沒有美觀的 papilla。若因為空間太小而 去修磨鄰牙(reduce tooth width),將導致牙齒的 contact area 變長,papilla 則會因此而變短。而且事實上, 因為牙根位置並沒有改變,所以植牙區的空間並沒有增加!!因此 Dr. Kokich 給矯正醫師的建議是 : Leave the natural contour for the papilla, Orthodontist !! 不要修磨 central distal & canine mesial,而是要 reshape 1st premolar mesial & distal 各 1/2 mm 和central mesial 1/4 mm。



Central	Lateral
8 mm	5.5 ~ 6.0 mm
9 mm	6.0 ~ 6.7 mm
10 mm	6.7 ~ 7.5 mm

Fig. 1a

Fig. 1b Related width of upper central and lateral incisors

在 reshape 後牙時, Dr. Kokich 不建議使用 disc 而是用 169L fissure bur,其尖端的直徑是 0.35 mm 而底端的直徑是 0.8 mm,因此使用底端修磨後在左右各會創造出 0.4mm 的空間,接著可以再使用 open coil spring 將 canine 後退。此時 Main wire 在 molar tube 前可以做個 stop 再加上 tie-back,如此一來就可以避免在 space regain 時造成 anterior flaring,之後加上 2 顆側門牙的 artificial teeth 來維持這空間。利用 open coil spring 來 create space,通常會 導致 canine 牙根的 mesial tipping 而影響 implant insertion,此時可在 canine 做 tip-back bend 來做調整。如此一來,雖然 canine 向後退 2 mm,但因在 root distal tipping 的同時 crown 也做了mesial tipping,所以可以維持 canine protection。利用這樣的方法,可以將 3 mm 的空間增加到 6 mm ! Dr. Kokich 在此提醒大家: Always, always, "Occlusion" first, then "Esthetics" !

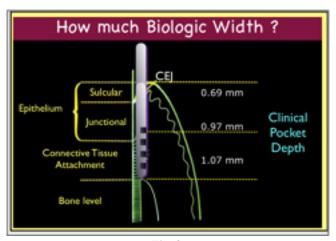
再來要考慮的是 space across the roots,這是 surgeon 會在意的問題。一般而言,因 root 是越來越細,所以若 是牙冠之間有 6 mm 空間,在牙根之間會有大於 6 mm 的空間。但是有些時候會有第一次矯正時矯正醫師自己所造 成之 "iatrogenic" incomplete finishing 的情況,也就是 root 太接近。若是使用 bridge 或 Maryland bridge 來 restore missing lateral 的話,並不用擔心這個問題。但若是要以 implant 來 restore 則會導致 implant 與鄰牙牙根太接近的 問題。像這一類的問題,只要在植入 implant 之前用 4~5 個月的時間做一些 minor tooth movement 來 upright root,就可以提供足夠的 space 給 surgeon 置入 implant。在上顎側門牙區置入 implant 時,Dr. Kokich 建議 implant 應植得靠近 canine 一些而不要太靠近 central,在 mesial side 留較多空間給 papilla 避免因為 contact area 太長而導 致 unesthetic short papilla,因為此處 papilla 較易被注意到。所以在 create space for implant 的病例中,我們必須同 時注意 Space across the crowns 和 Space across the roots !

What if the central incisor is short?

在這一類病例中,我們必須評估兩點:1. Tooth-size, 2. Gingival level。首先要評估 upper central incisor 的寬/ 長比率是否正確,一般 upper central incisor的寬/長比率約為 70~80 %。如果比率不正確,我們必須先判別原因,

這個時候就必須根據 gingival level 來做評估,因此 必須要先做 probing,事實上這個地方 Dr. Kokich 所 指的是 "sounding" 。一般正常的狀況下, clinical probing depth 是由 gingival margin 到 sulcus 再加上 sulcus 到 bone 的距離(Fig. 2)。一般而言 sulcus 應該 在 gingival margin以下1 mm 的位置,而 bone level 應 該在 sulcus 以下 2 mm 左右。

因為 lateral incisor implant head 的位置是根據 canine 以及 central incisor 的 gingival margin 來決定 的, implant head position 應剛好位於這兩顆牙的



gingival margin 連線以下 3 mm 處。Dr. Kokich 在此提出幾個臨床上常見的問題:

- What if gingival levels are not correct after orthodontic treatment?尤其是青少年患者在矯正治療後常會遇到這個問題!評估這樣的情形我們還是必須先做 probing,若 gingival margin 到 sulcus 的距離是 3 mm,而牙齒的 incisal edge 又沒有 attrition 的現象,表示這是因為 altered passive eruption 所造成的,也就是說 gingiva 沒有 migration 到距離 CEJ 1 mm 處,解決方式就是要在植入 implant 之前先做 gingival surgery。Timing of gingival surgery: Right before implant placement !!
- Should gingival surgery ever be performed before orthodontics?這個答案是肯定的!尤其是在單側 lateral incisor missing 的 case,對側的 lateral incisor 通常都是 malformed 的 peg lateral,在 bonding 矯正器之前應該要先復形成與 central incisor 的比例相符的大小再 bonding。但是這類 malformed tooth 通常 clinical crown 很短,所以必須在做 restoration 之前先做 gingival surgery。Timing of gingival surgery: Gingival surgery => Restoration of peg lateral => Orthodontic treatment.
- What if gingival surgery won't correct the crown length discrepancy? 這類 case 在 probing 後通常會發現 sulcus depth 是正常的(1 mm),但是若從 incisal surface 看,可以觀察到 incisal edge abrasion 的情形,因此 gingival surgery 是無法解決這個問題的!!這種情況下必須要將已經被 attrition 的門牙先做 intrusion,之後拆 bracket 將牙齒補長, restore 成比較理想的 proportion,之後再繼續進行 ortho 治療。這裡有一個訣竅就是,要把門 牙盡量補長一點,在做 finishing 時再修短即可!另外,Dr. Kokich 建議的 intrusion 方法是用 .018 SS wire 做 intrusive step,因為在圓線上做 intrusive step 才不會有 torque 的變化,千萬不要在方線上灣 step !!

What happens to the papilla during space opening?

在 create space 之前,我們只有一個 papilla,但是在治療結束時植入 implant 之後,我們需要兩個 papillae— Never gets TWO from ONE !! 大原則就是: Papilla always stays right next the tooth that doesn't move !! 在這裡,Dr.

Kokich 要介紹一個名詞叫做"Atherton's patch",這是不健康的非角化牙齦,產生"Atherton's patch"的原因不是因為 bone level,而是因為 sulcus!(Fig. 3)因此這個情形若發生在 Adolescent patients,因牙齒還會萌發,而 tooth eruption 會幫助 normal sulcus 的形成,所以 Atherton's patch 情況會隨時間而改善。但若發 生在 Adult patients,則因為牙齒已經不會 eruption,所以 Atherton's patch的情況只能藉由 surgery correction。(flap margin 翻在 central

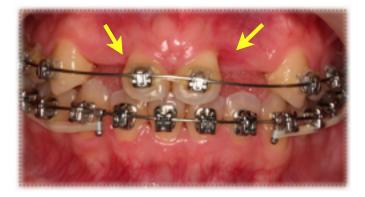


Fig. 3 紅色區域就是 Atherton's patch, 是 sulcus 底部外翻所造成的,不是 bone level !!

incisor mesial side, suture 時將 flap 往 palatal side 縫合,手術兩個月後, 換成 ridge-lap retainer, 2nd stage 時 tissue punch 盡量靠近 canine,讓 papilla 可以癒合)。為了避免造成 congenital missing one lateral incisor 日 後矯正 midline 時導致 unesthetic missing papilla, Dr. Kokich 建議我們在 follow 單側 lateral incisor congenital missing 的患者時,最好在有 lateral incisor 那一側的側門牙要萌發時拔除該側的乳犬齒,以利側門牙往 distal 萌發,並盡量保留 congenital missing 那一側的乳犬齒,以維持 dental midline。(Fig. 4)

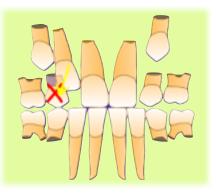


Fig. 4

At what age may single -tooth implant be placed?

當 permanent dentition fully erupt 才可以植入 implant ! No implant should be placed in "growing" individuals until the permanent dentition is fully erupted !! 但我們如何知道患者是否還有生長呢?答案是當 Facial height (N to Me) 沒有改變時即表示生長完成了⁵!!Dr. Kokich 建議我們每半年 check 一張 Lateral cephalometrics 去做 superimposition 就可以得知生長是否停止。因此,矯正醫師是決定何時可植入 implant 的 key person !!

至於矯正後的空間維持, Dr. Kokich 建議第一年用 removable Hawley retainer, 第二年以後改用 .030 wire 加上 resin tooth 的 lingual fixed retainer, 通常可以維持約五年的時間。 另外要特別注意的是,缺牙空間不可放置mini-implant as temporary restoration。因為相鄰牙齒仍然會有 eruption, 而這樣的 eruption 會提高鄰牙的 bone level, 相較之下, 植入 mini-implant 的位置 bone level 會變成 reversed architecture, 以後要植入 permanent implant 時會有 vertical defect 的問題。

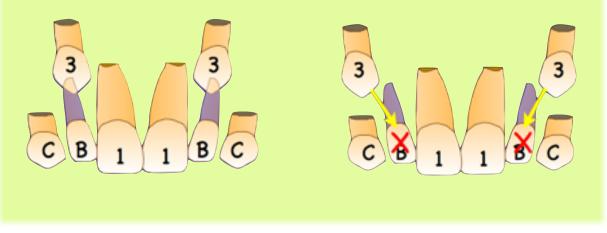


Fig. 5

Fig. 6

5 Do edentulous ridges resorb with time?

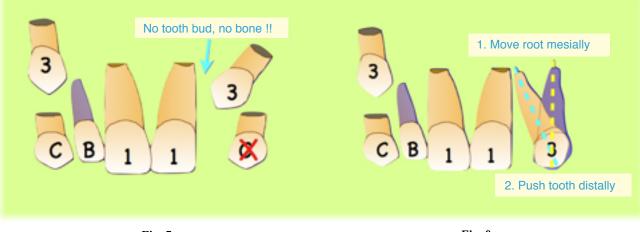
當然會!! 但這可以分成兩種 type 來探討: Extraction socket: 拔牙後的前六個月 ridge 寬度會有 23% 的吸收,接下來的五年內會有另外 11% 的吸收, 所以一個 extraction socket 在五年內寬度會萎縮 34%; Congenital missing: 5 年內 ridge 的吸收小於 1%。以現在 implant 技術, Dr. Kokich 建議若 ridge 的狀況很不錯,可以使用"indexed" flapless surgery 加上 immediate restoration, 通常 result 都很不錯!

Should primary teeth be extracted?

在 congenital missing bilateral lateral incisors 的狀況下,是否應先拔除乳牙呢?我們必須先拍 periapical film or pano,確定canine與其他牙齒的位置。若 canine 往 primary lateral incisor 方向長則不需拔除乳牙(Fig. 5);但若 canine 往 primary canine 的方向萌發,則需先拔掉 primary lateral incisor,留下primary canine,之後再將 permanent canine retraction 到定位(Fig. 6)。如果 canine erupts in an angle,我們必須先把 canine root 移到缺 bone 區再移回正確位置(first move canine root mesially, then push tooth distally !!),利用矯正把 bone quality 提 高!(No tooth bud, no bone !!)(Fig. 7, Fig.8)

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The Application of Mini-screw Anchorage in Class II Malocclusion and Deep Bite – A Case Report

[Abstract]

The application of mini-screw anchorage are remarkably successful in many types orthodontic treatment, such as correction of bimaxillary protrusion, Class II or Class III malocclusion, molar distalization in crowding cases, intrusion of elongated posterior teeth, midline correction, and correction of occlusal plane canting and posterior cross-bite. Mini-screw anchorage is mainly used in maximal retraction cases. However, due to mucosal irritation in the anterior area, the use of mini-screw in deep bite correction is very few. In this case, a mini-screw was inserted in the subapical area of anterior teeth with a closed technique and an extension hook was created using a .012" ligature wire. An elastic chain was hung between the archwire and the extension hook to provide an intrusive force for anterior teeth. In three months, the deep bite was effectively corrected. Site selection and insertion techniques of the usage of anterior mini-screw anchorage are discussed in this report.

[Keywords] mini-implant anchorage, deep bite, incisor intrusion.

Introduction

The application of mini-screw anchorage are remarkably successful in many types orthodontic treatment, such as correction of bimaxillary protrusion, Class II or Class III malocclusion, molar distalization in crowding cases, intrusion of elongated posterior teeth, midline correction, and correction of occlusal plane canting and



Fig. 1 Extra-oral view of the patient before treatment. Note the obvious peri-oral protrusion and lip incompetency.



Fig. 2 Intra-oral view of the patient before treatment. The overjet and overbite were both large. Right and left sides were both Class II occlusal relationship.

posterior cross-bite. Mini-screw anchorage is mainly used in maximal retraction cases. However, due to mucosal irritation in the anterior area, the use of mini-screw in deep bite correction is very few. In this case, an attempt was made to place a mini-screw in the maxillary posterior area to correct the overjet. However, the anterior deep bite impeded the movement. After six months' use of lever arm intrusion arch, the improvement of overbite was not significant. We decided



Fig. 3 Pre-treatment panoramic radiograph of the patient showed no specific findings

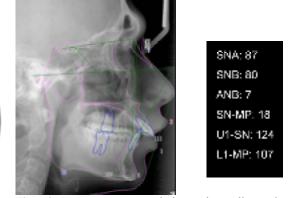


Fig. 4 Pre-treatment cephalometric radiograph. Patient's skeletal relationship was Class II, ANB was 7[°]. His mandibular plane angle was relatively small, SN-MP was 18[°]. Upper and lower incisors were all procumbent, U1-SN was 124[°], L1-MP was 107[°].

FEATURE NTO 16

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to put mini-screws in the anterior area to provide an intrusive force. After three months of treatment, the deep bite was corrected. The overjet and the facial profile were improved in the meantime. With this successful experience, we started to use mini-screw anchorage in many tough deep bite cases.

Case report

Clinical examination

This 22 years old male patient complained of maxillary incisor protrusion. There was no obvious asymmetry in the frontal view. The vertical proportions were within normal limits. Lip incompetency was noted during rest. No gummy smile and midline deviation was found in the smiling view. Lateral view showed a convex profile and the nose was very big . His maxilla was very protrusive, while his mandible was at a normal position (Fig. 1). The intra-oral examination revealed flaring upper incisors and the overjet was 12.5 mm. The overbite was about 6 mm with lower incisor impinging into the upper palatal gum. The upper and lower dental arches were both ovoid and symmetrical. There was 10 mm excessive space in the upper dental arch. Bilateral molar and canine relationships were both in a Class II relationship (Fig. 2).

Radiographic examination

There was no specific finding in the panoramic film, and all wisdom teeth were missing (Fig.3). Cephalometric readings revealed a skeletal Class II relationship (ANB : 7°) and very low mandibular plane angle (SN-MP : 18°). The upper incisors were quite procumbent (U1-SN : 124°), and the lower incisors were also proclined (L1-MP : 107°) (Fig.4).

Diagnosis and treatment plan

With all the findings above, the patient was diagnosed with a severe Class II malocclusion caused by maxillary protrusion. Both upper and lower incisors were proclined, and the overjet and overbite were both large. The mandibular plane angle was very low.

Treatment plan A: single-arch extraction therapy. Extract bilateral upper first bicuspids and finish at a Class II molar relationship.

Treatment plan B: non-extraction therapy. Retract upper dental arch to a Class I molar relationship with mini-screw anchorage.

Although upper single-arch extraction is more favorable for large overjet, we decided to try non-extraction therapy first with mini-screw anchorage with the considerations of the patient's low mandibular plane angle and a strong bite force. If the situation didn't improve as expected, we could then shift to an upper single-arch extraction therapy.



Fig. 5 Five months after initial bonding. The upper arch wire was 16×22 NiTi, and the lower arch wire was 17×25 TMA. Bilateral lever arms made of .017 x .025 TMA wire were added to upper arch for bite opening. The anchorage was provided by mini-screws at the upper posterior area, and the anterior teeth were retracted by NiTi coil springs.



Fig. 6 Eight months after initial bonding. The overbite was still deep, and the overjet didn't decrease.

Treatment procedure (Fig. 5,6,7)

- **93/05/15** Upper arch was full strapped up with fixed appliance and .016 NiTi initial arch wire were inserted.
- **93/05/28** Two mini-screws (J-screw, 2 mm in diameter, 12 mm in length, Bio-Ray Biotech Corporation, Taiwan) were inserted at bilateral infra-zygomatic crest.
- **93/07/06** Lower arch was full strapped up with fixed appliance and .016 NiTi initial arch wire were inserted.
- **93/08/03** Change upper arch wire to .016 x.022 NiTi. Use mini-screw anchorage to retract upper anterior teeth with NiTi coil spring.
- *93/09/03* Bilateral lever arms made of .017 x .025 TMA wire were added to upper arch for bite opening. (Fig.5)
- **93/11/02** Change lower arch wire to .016 x .022 reverse curve NiTi for bite opening
- 94/01/18 The deep overbite didn't improve at all (Fig.6)
- 94/03/25 A mini-screw (J-screw, 2 mm in diameter, 10 mm in length, Bio-Ray Biotech Corporation, Taiwan) was





Fig. 8 After the overbite were opened, the upper anterior teeth were retracted smoothly.

inserted in the sub-apical area of upper incisors with an extension hook made by .012" ligature wire. An elastic chain was hung between the arch wire and the extension hook to provide the intrusive force for anterior teeth. (Fig.7)

- 94/04/22 One month later, the deep overbite was improved. We put another mini-screw in the lower anterior subapical area. (Fig.7)
- **94/06/08** The overbite was opened quite enough, so we changed lower arch wire to .016 x .022 SS. (Fig.7)
- 94/07/12 Once the overbite was opened, the upper anterior teeth retracted efficiently. Remove the lever arms. (Fig.8)
- **94/12/04** Change upper arch wire to .016 x.022 SS and continue space closure with NiTi coil spring.
- **95/04/07** Cut wire and remove the posterior wire segments. Have the patient to wear up-and-down finishing elastics. (Fig.9)
- 95/05/06 Full-mouth fixed appliances and miniscrews were removed.

Fig. 7 Insert a mini-screw at the upper anterior subapical area (J-screw, 2 mm in diameter, 10 mm in lenghth, Bio-Ray Biotech Corporation, Taiwan) with an extension hook made by .012" ligature wire. An elastic chain was hung between the arch wire and the extension hook to provide an intrusive force for anterior teeth. One month later, the deep overbite was improved and we put another mini-screw at the lower anterior subapical area. Another month later, the deep bite was fully corrected.



Fig. 9 The posterior wire segments were cut and removed, and up-and-down finishing elastics were prescribed.

After Two-years treatment, there was much improvement at the protruding maxilla, lateral profile and the lip incompetency (Fig.10). The patient's molar relationship became a ideal Class I relationship. His overjet and overbite were corrected to an average range. (Fig.11).

Discussion

In this case, we can easily correct the large overjet and Class II relationship with mini-screw anchorage. However, when the overbite is too deep, the occlusal interference will impede the correction.

The post-treatment panoramic radiograph showed good parallelism between the roots, and there was no pathological changes of the incisors after massive retraction and intrusion (Fig.12).

The post-treatment cephalometric radiograph revealed obvious improvement at the relationship between maxilla and mandible (ANB from $7 \circ$ to $3 \circ$). The upper incisors were

retracted and uprighted. (U1-SN from 124 to 93) (Fig. 13). The superimposition of pre-treatment and post-treatment cephalometric radiographs showed 10 mm retraction of the upper incisors at the incisal edge and 2.5 mm retraction at the root tips. Aside from the massive retraction of upper incisors, there was 2.5 mm backward movement of upper molars caused by the retraction of whole upper dentition after space closure. Extrusion of the upper molars caused the SN-MP angle increase from 18 to 23 and consequently, resulted in inadequate vertical control. Although this was not a severe side-effect in this case, it could be a problem in long-term stability. It would be better to pay more attention about vertical control in hyper-divergent cases to prevent this side-effect.

Lever arm intrusion arch could be an effective appliance of incisor intrusion in many cases. However, we didn't see any progress in this case after 6-months' usage. We decided to put a mini-screw in the subapical area of anterior teeth and made an extension hook with .012" ligature wire. An elastic chain was



Fig. 10 Post-treatment Extra-oral view. There was much improvement in the maxilla, lateral profile and the lip incompetency.



Fig. 11 Post-treatment Intra-oral view. Patient's molar relationship became an ideal Class I relationship. His overjet and overbite were corrected to normal range.

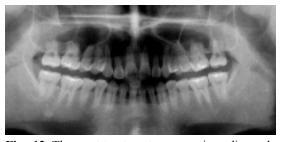
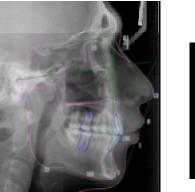


Fig. 12 The post-treatment panoramic radiograph showed good parallelism between the roots. No abnormality of the incisors was found after massive retraction and intrusion.



SNA: 81 SNB: 78 ANB: 3 SN-MP: 23 U1-SN: 93 L1-MP: 108

Fig. 13 The post-treatment cephalometric radiograph showed much improvement in skeletal Class II relationship and the upper incisors became more upright.

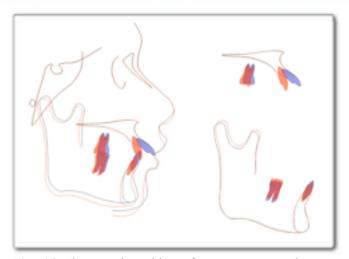


Fig. 14 The superimposition of pre-treatment and posttreatment cephalometric radiograph showed 10 mm retraction of upper incisors at incisal edge and 2.5 mm retraction at root tips. Aside from the massive retraction of upper incisors, there was 2.5 mm backward movement of upper molars caused by the retraction of whole upper arch after space closure.

hung between the archwire and the extension hook to provide an intrusive force for anterior teeth. In three months, the deep bite was effectively corrected and there was significant improvement in decreasing overjet in the same time.

In the past it was problematic to use mini-screws to intrude incisors because the exposed part of miniscrews tended to cause mucosal ulcerations. In this case, the miniscrew was submerged under mucosa using a closed technique to reduce the possibilities of soft tissue ulceration.

In order to decrease the bulging irritation of the screw under the mucosa, the authors cut off the head of the miniscrew before implantation with a heavy wire cutter. The extension hook made by ligature wire was hooked under the shoulder of the miniscrew to avoid the interference of a screw driver when removing the screw. With this technique, one doesn't need to cut the ligature wire first when removing the screw, which keeps the incision during miniscrew removal to the minimal.

The extension hook made by ligature wire may compress the gingival tissue in cases of protruding alveolar bone. The ligature wire hook should be extended long enough so that the gingival tissue won't imbed it. Using stiffer material to make the extension hook can also prevent the compression of the gingival.

We had tried to put miniscrews between the roots of

anterior teeth, but the danger of damaging of the root surface was a big concern. With the insertion site shift to anterior subapical area, we can easily prevent the damage of the roots and reduce the psychological pressure of the operator. Hence, pre-operation examinations for prevention of root damage is unnecessary now.



Fig. 15

The size of the miniscrew is the same as we used in the posterior teeth area, 2 mm in diameter and 10 mm in length. There is no need to choose thinner screws because it is quite safe to put the miniscrews at anterior subapical area (Fig.15).

Because the mucosa covering the anterior subapical area is movable, the authors made a vertical incision, about 2~3 mm, just in the neighborhood of the labial frenum before miniscrew insertion. Detect the bone surface of the insertion area by a periosteal elevator or explorer, then insert the miniscrew perpendicular to the bone surface. After drilling about 2 or 3 threads of the screw into the cortical bone, change the inserting angle, about 45 degree to the occlusal plane to keep it from damaging the roots. Since we usually use the selfdrilling technique to insert screws, it is important to note that

Table 1 CEPHALOMETRIC

SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA°	87°	81°	-6°
SNB°	80°	78°	-2°
ANB°	7°	3°	-4°
SN-MP°	18°	23°	5°
FMA°	14.5°	18.9°	4.4°
DENTAL ANALYSIS			
U1 TO NA mm	12.4 mm	3.9 mm	-8.5 mm
U1 TO SN°	124°	93°	-31°
L1 TO NB mm	6.3 mm	5.5 mm	-0.8 mm
L1 TO MP°	107°	106°	-1°
FACIAL ANALYSIS			
E-LINE (U)	1.9 mm	0.3 mm	-1.6 mm
E-LINE (L)	1.1 mm	0.9 mm	-0.2 mm

the initial insertion angle should be perpendicular to the bone surface. Otherwise, the instruments will slip and may cause laceration of the soft tissue (Fig.16). The ability of the screw driver to hold the screw tightly is also very important. When one accidentally slips the grip and the screw driver does not hold the screw securely, more efforts will be required to find the lost screw in the spaces between soft tissues.

The ligature wire should be tied on when the mini-screw is inserted to the level of the mucosal surface, and then keep on inserting the screw until it is imbedded under the mucosa. As for the incision wound, it is so small that suturing is unnecessary. The next step is to make a hook on the tightly twisted ligature wires by a ligature wire director (Fig.16).

There are two ways to hang power chains between an extension hook and an arch wire. One is using ligature wire to lead the last ring of the power chain pass through the first ring, tie the power chain to the arch wire, and then hang it on the hook in an appropriate length. The other way is to hang one end of the power chain on the hook, and then tie the other end to the arch wire by a ligature wire (Fig.17).

Conclusion

The application of mini-screws in clinical orthodontic treatment has provided orthodontists greater ability in treatment

quality control because it reduces the level of patient's compliance. Traditionally they are used for anterior-posterior control. However, this case demonstrated its capacity in overbite control. The modified insertion technique and insertion site made it more manageable to implant mini-screws in the anterior subapical area. With this successful experience in overbite control by anterior subapical miniscrews, we subsequently extended the application in some gummy smile cases. A very successful treatment result was achieved with this approach, and the use of mini-implant has changed our treatment model for overbite control and gummy smile correction.

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Fig. 16 Clinical steps to insert anterior subapical mini-screws. (a) use heavy wire cutter to cut off the head of the screw. (b) make a vertical incision, about $2\sim3$ mm, in the neighborhood of the labial frenum. (c) insert the screw perpendicular to the bone surface. After self-drilling about 2 or 3 threads of the screw into the bone, turn the inserting angle, about 45 degree to the horizon, to keep it from damaging the roots. (d) when the screw is inserted to the level near the mucosal surface, stop drilling. (e) tie a segment of .012" ligature wire under the shoulder of the screw. (f) use needle holder to twist the ligature wire to appropriate length. (g) keep on inserting the screw until it was imbedded under the mucosa. (h) use ligature wire director to make a hook.



Fig. 17 Two ways to hang power chains between extension hook and arch wire.(a) One way is to use ligature wire to lead the last ring of the power chain pass through the first ring, tie the power chain to the arch wire; then hang it to the hook in an appropriate length. (b) The other way is to hang one end of the power chain on the hook and then tie the other end to the arch wire by a ligature wire.



Management of Buccally Erupted Canines and Lower Midline Deviation - A Case Report

When I was an orthodontic resident in 1979, we were given the impression that any crowding more than 5 mm in the maxillary arch and any crowding more than 3 mm in the mandibular arch would require removal of teeth. Hence, the majority of our orthodontic patients were treated with removal of teeth. At that time, the orthodontic forces used were rather heavy. Loss of anchorage by mesial movement of the molars while retracting the anterior teeth happened most of the time. Head gear was often indicated for extraction cases to prevent anchorage loss. However, compliance to head gear wear depended solely on the patient cooperation. Often head gears were not worn sufficiently and would lead to poor orthodontic result. The patients were blamed for such poor results.

Fast forward 30 years and we are now in the year 2009. The rule of 5 mm crowding in the maxillary arch and 3 mm crowding in the mandibular arch that requires removal of teeth is no longer valid. Now, we have low force, low friction, passive self-ligating bracket system that allows widening of the arches. Cases that "definitely" needed extractions in the past can now be treated without extractions. This is a case report of such a patient.

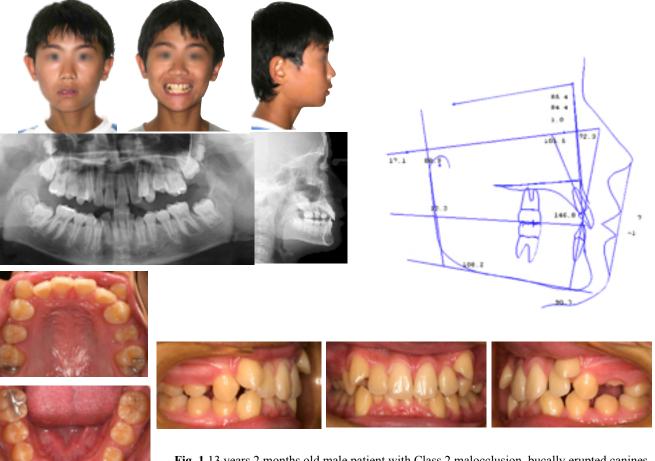


Fig. 1 13 years 2 months old male patient with Class 2 malocclusion, bucally erupted canines, slanted lower incisors and moderate crowding in both arches before treatment.

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Diagnosis

The patient was a 13 years and 2 months old, male Japanese. His main complains were the bucally erupted canines and severe crowding of the maxillary and mandibular arches. His parents were not sure when treatment should start as he just lost the upper left primary 2nd molar. Pre-treatment facial photographs showed a normal profile with slight lip separation. The pretreatment intra-oral photographs showed four bucally erupted canines with a mild right and left Class 2 molars. The over jet was 3.5 mm and there was deep bite. Although there was presence of leeway spaces, when space analysis was done, there was 6 mm upper crowding and 7 mm lower crowding. The lower dental midline was shifted to the right (Table 1, Fig 1).

CE	PHALOMETRIC	
	PRE-TX	POST-TX
SNA°	85.4°	88.2°
SNB°	84.4°	85.3°
ANB°	1.0°	2.9°
FMA°	17.1°	20.2°
IMPA°	90.7°	109.0°
FMIA°	72.3°	50.8°
U1 TO FH plane°	105.5°	106.7°
Gonial angle°	108.2°	109.6°
Ramus inclination (FH)°	88.9°	91.0°
Occlusal plane°	10.3°	15.1°
Wits Appraisal	-3.7 mm	–1.5 mm
ANS – Me	61.5 mm	63.9 mm
Interincisal Angle°	146.8°	124.1°
Lower Lip E-plane	–1.0 mm	0.23 mm
Z Angle°	73.5°	65.8°

 Table 1
 CEPHALOMETRIC DATA (TWEED ANALYSIS)



Fig. 2 Initial .012 thermal nickel titanium maxillary archwire.



Fig. 3 .012 thermal nickel titanium maxillary archwire. After 6 weeks of upper arch treatment. Maxillary right and left canines moved occlusally.



Fig. 4 .012 thermal nickel titanium maxillary archwire. After 10 weeks of upper arch treatment. Maxillary right canine in good alignment



Fig. 5 Started lower arch treatment. .012 thermal nickel titanium mandibular archwire. .013 thermal nickel titanium maxillary archwire. After 4 months of upper arch treatment. Maxillary right canine is in good alignment.



Fig. 6.016 x .025 nickel titanium maxillary and mandibular archwire. After 11 months of treatment in upper arch and 7 months in lower arch.



Fig. 7 .017 x .025 stainless steel maxillary and mandibular archwire. Bite turbo at palatal surfaces of upper right and left central incisors for bite opening. Class 2 elastic for correction of molar Class 2 relationship. Lower dental midline corrected. After 17 months of treatment in upper arch and 13 months in lower arch (just before debonding).

Treatment objectives

The treatment objectives were to align all bucally erupted canines, correct lower dental midline shift, correct the slanted lower incisors, improve smile, correct crowding and to do all these without removal of teeth as the upper and lower lips appear to be thin when the patient was smiling. Orthodontic treatment should start immediately in order to make full use of the lee-way spaces present.

Treatment procedure

Damon D3 brackets were used (Ormco .022 slot, passive self-ligation). In the maxillary arch, a .012 thermal Niti archwire was used for 10 weeks as the initial arch wire (Fig. 2, 3 and 4). It is important to note that the .012 Niti wire was changed after 5 weeks, to a new .012 Niti arch wire, as it is thin and prone to distortion by masticatory forces. This thin archwire can also be distorted when using finger nail to push it into the

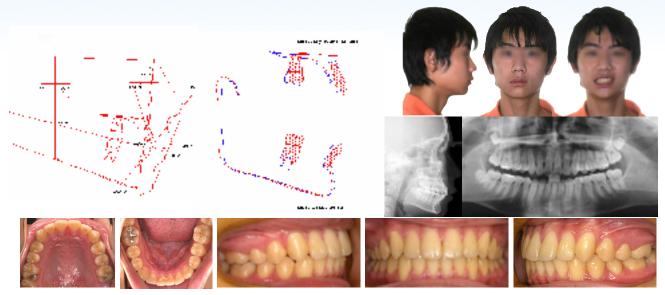


Fig. 8 Patient at completion of treatment, 17 months after bonding of maxillary teeth and 13 months after bonding of lower teeth.

slot. Care must also be taken not to hold this thin archwire with a plier which can also distort it. Handle this archwire only with fingers.

This was followed by a .013 thermal Niti archwire for 16 weeks. Do note that the .013 Niti wire was changed after 8 weeks for the same reason given above. After the alignment of the upper right and left canines, an upper .016 x .025 thermal Niti archwire was used for 8 months. Bite turbos were placed on the palatal side of the upper right and left central incisors to assist in bite opening. The last upper archwire was a .017 x .025 stainless steel. Class 2 elastics ($\frac{1}{4}$ inch, 4.5 oz) were used for 2 months to correct the mild Class 2 problems.

Bonding on the mandibular arch was delayed for 4 months as the problems in maxillary arch were more complex and needed more treatment time to correct than the mandibular arch (Fig. 5). In the mandibular arch, a .012 thermal Niti arch wire and was used for 12 weeks as the initial arch wire. Together with the .012 thermal Niti, a Niti open coil spring was used to correct the lower dental midline deviation and to open space for the lingually placed lower right lateral incisor. The Niti open coil spring was activated only by 3 mm as the .012 Niti archwire was very flexible. Too much activation of the Niti open coil spring will cause the .012 Niti archwire to be pushed out labially. This was followed by the use of a .014 thermal Niti archwire for 8 weeks. After the alignment of the lower right and left canines, a .016 x .025 thermal Niti archwire was used for 5 months (Fig. 6 and 7). The last lower arch wire was a .017 x . 025 stainless steel.

Treatment results

Treatment was completed in 17 months after the bonding of the maxillary arch and 13 months after the bonding of mandibular arch. All the bucally erupted canines were well aligned. The mild class 2 molars relationship, upper and lower crowding were corrected. The smile was improved and the profile is normal (Fig 8).

Conclusion

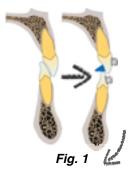
The case demonstrates that by using low force, low friction, passive self-ligation brackets, what was definitely an extraction case in the past, can now be treated without extraction. The anterior palatal bite turbos were effective in opening the bite. Most patients prefer not to have teeth removed for orthodontic treatment. If the facial profile does not present with bilabial protrusion, lack of lip seal or thick lips, non extraction treatment should be preferred even in the presence of moderate crowding. It is important to remember that extraction is for the face and not for space.



Correcting Deep-bite with Fixed Bite Ramps

Story and illustration by Rungsi Thavarungkul. D.D.S., M.S.





B ite Ramps are fixed bite stops that we place on the lingual side of the upper central incisors to act as anterior bite raiser in deep-bite cases. When deep-bite opens, orthodontist can easily manipulate and correct malocclusion for three advantages. (*Fig. 1* Show advantages when use Bite Ramp in deep-bite case.)

Orthodontists can bond the mandibular anterior or even the mandibular posterior teeth at the start of treatment.

The bite force is temporarily reduced which facilitates teeth movement.

It's very effective because patients wear them full-time and they are more hygienic, comparing to removable bite planes or lingual arch fixed bite planes.

For example, this patient's deep bite had already been corrected in 4 months. (*Fig 2a-d*) How about the traumatic occlusion on the central incisors? Does it increase the chance of accidental debonding? Philippe asserts that "accidental de-bonding of a bonded bite-plane is rare because occlusal forces are moderated by the propioceptive reflex, and most pressure is directed against the tooth surfaces" ⁽¹⁾

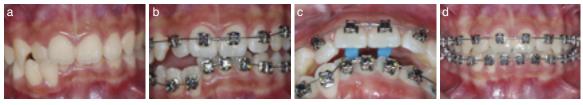


Fig. 2 a. Initial (15y, 3m)

b. c. Bracket placement with 2 Bite Ramps had been placed. (15y, 3m)

d. Malocclusions were almost corrected at 4th month of treatment (15y, 7m)

Fig. 3a-c By using preform Bite Ramp mold and light activated dental materials, orthodontist can construct Bite Ramps faster and easier.





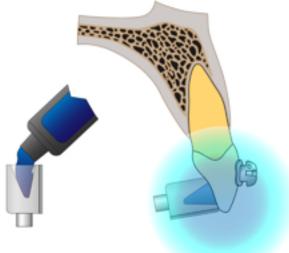


Fig. 3b Fill the mold with light -curing material

Fig. 3c Press the filled mold to the bonded incisor then light cured. My favorite bite ramp is the kind made from silicone molds following to these simple steps. (Fig 3a-c)

- 1. Etch the lingual surface of both central incisors.
- 2. Rinse and dry.
- 3. Apply bonding agent.
- 4. Fill up the preform Bite Ramp mold with blue resin (BandLock from Reliance) or modified glass ionomer cement (Optiband Ultra from Ormco)
- 5. Press the filled mold to the etched lingual surface.
- 6. Light curing
- 7. Repeat step 4 to 6 for another tooth
- 8. Let patient bite and then adjust or reline the bite ramp until the lower incisors bite evenly on both ramps.

Let's see how the Bite ramp works in one more deep bite case. A 14-year-and-4month old male, presented with a good profile and Class I malocclusion, with an accentuated curve of Spee and deep overbite. His lower right canine was totally blocked out. (*Fig 4a-c*)

Panoramic x-ray showed sound periodontal condition of all teeth. Lower right canine tilted distally, approximately 30° to the vertical axis. (*Fig 4d*) Cephalogram showed normal basal bone relationship while maxillary and mandibular incisors tilted lingually.(*Fig 4e*)

The 0.022 x 0.027 passive selfligation system (Damon 3MX) was selected to treat this malocclusion. Normally bonding bite ramps at the first visit is advised since it could decrease treatment time. However, for severe lingual tipped upper central incisors it may create an adverse force system that the vertical force vector may pass behind the center of rotation (Cr) which can lead to undesired, more lingual tipping movement. In this situation I preferred to bond these bite ramps after both of central incisors had been slightly proclined to make sure that the force vector will pass in front of Cr. (Fig 5)



Fig. 4a-4c 14 y 4 m old Class I patient with deep-bite, Initial records (14y, 5m).

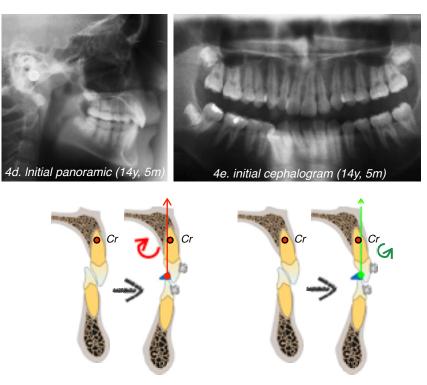


Fig. 5 (left)Severe lingual tipped upper central incisors may create an adverse force system that the vertical force vector may pass behind the center of rotation (Cr) which can lead to undesired, more lingual tipping movement. (right) Mild lingual tipped upper central incisor create more preferable force system.

Since the patient's occlusion had been raised by the bite ramps, the lower braces could then be placed. (Fig 6a-c)



Fig. 6a-c Bite Ramps and lower appliances were placed after 2nd month of treatment (14y, 7m)

After the lower teeth had been leveling for 2 months and the upper teeth alignment were ready for the first rectangular CuNiTi arch-wire (0.014×0.025), the patient was instructed to use light vertical elastic (3/16, 3.5 oz.) full time to reestablish the occlusion in premolars segment. The full-time light vertical elastic should be assigned to the patient until the teeth had been aligned by sequential arch-wire progress from 0.014 CuNiTi, $0.014 \times 0.025 \text{ CuNiTi}$, $.018 \times .025 \text{ CuNiTi}$ and finally 0.019×0.025 Stainless Steel. Bite Ramps had had been removed before the final rectangular Stainless Steel arch-wire was placed. (*Fig 7*)



Fig. 7 Patient had been assigned to use fulltime light vertical elastic since 4th month of treatment (14y, 9m)



Fig. 8 Utilize of self-bending 0.016 TMA uprighting spring to upright lower left canine.

During leveling and aligning, self-bending 0.016 TMA uprighting spring was used as an add-on to upright the distally tipped lower right canine. (*Fig 8*) After 17 months of treatment, the malocclusion had been corrected. The patient was ready for de-bonding (*Fig 9*).



Fig.9 Final (15y, 10m)

There is no observatory alteration of the maxillary and mandibular incisors root in the pre- and post-treatment panoramic radiogram after the use of the bite ramp. (*Fig. 10*)



Fig. 10a Initial (14y, 5m)



Fig. 10b After treatment (15y, 10m)

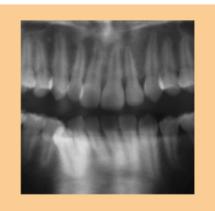


Fig. 10c Initial (14y, 5m)

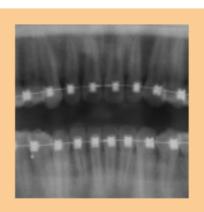


Fig. 10d Final (15y, 10m)

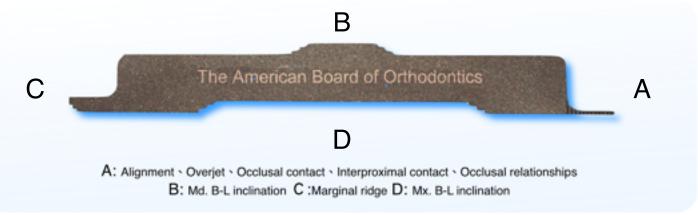
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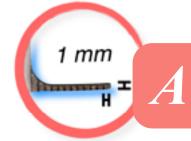
How to Use the ABO Measuring Gauge

To make the phase III clinical examination a fair, accurate, and meaningful experience, the American Board of Orthodontics develops the ABO grading system and special ABO measuring gauge. This Objective Grading System can not only enhance the reliability of the examiners but also provide the candidates with a tool to assess the adequacy of their finished orthodontic results.

With the ABO Objective Grading System, all orthodontic practices may take a diagnostic cast to check if further improvement could be made before de-bonding. Also one can level up the quality of treatment result.



Each portion of the ABO measuring gauge is designed to measure certain conditions of the casts. It is 0.5 mm in thickness, 1 mm in width and each step measures 1 mm in height.



Each step measures 1 mm in height and 1mm in width. It was designed for measurement of Alignment, Overjet, Occlusal contact, Interproximal contact & Occlusal relationship.

Alignment :

In the maxillary anterior area, proper alignment is characterized by coordination of alignment of the incisal edges and lingual incisal surfaces of incisors and canines. Also the incisal edges and labial incisal surfaces of the mandibular incisors and canines .

In the maxillary posterior quadrants, the central grooves of posterior teeth should all be in the same alignment.





Dr. Chia-ling Huang Elegant Orthodontic and Pediatric Dental Clinic Lecturer, Beethoven Orthodontic Course





In the mandibular posterior quadrants, the mesiobuccal and distobuccal cusps of the molars and premolars should be in the same mesiodistal alignment. If all teeth are in alignment or within 0.5 mm of proper alignment, no points are subtracted. If the mesial or distal alignment at any of the contact points is greater than 0.5 mm deviated from proper alignment, 1 point shall be subtracted for the tooth that is out of alignment. If adjacent teeth are out of alignment, then 1 point should be subtracted for each tooth.

Though mandibular premolars have great variation of morphology, it is not easy to determine the rotation and alignment. Drawing lines of mesial-distal and buccal-lingual reference lines will ensure proper alignment. If there is any discrepancy in alignment, orthodontists can correct it in time.

Overjet :

In the anterior region, the mandibular canines and incisors will contact the lingual surfaces of the maxillary canines and incisors. If the mandibular canines or incisors are not in contact with the lingual surfaces of the maxillary canines and incisors, when the distance is 1 mm or less, then 1 point is subtracted for each tooth. If the discrepancy is greater than 1 mm, then 2 points are subtracted for each tooth. The width of gauge is 1 mm, and if the width of gauge can't be put into the gap, 1 points is subtracted. If the width of gauge can be put into the gap, 2 points are subtracted.

In the posterior region, the buccal cusps of the mandibular molars and premolars will contact the center of the occlusal surfaces of maxillary posteriors. If the mandibular buccal cusps deviate 1 mm or less from the center of the opposing tooth, 1 point is subtracted for that tooth, If the position of the mandibular buccal cusps deviates more than 1 mm from the center of the opposing tooth, two points are subtracted for that tooth. When evaluating, tilting the cast or view from posterior is easy to measure in this region.



Occlusal Contact :

All functional cusps of maxillary and mandibular posterior teeth, including buccal cusps of **man** dibular premolars and molars and the lingual cusps of the maxillary premolars and molars should **cont**ect the occlusal surfaces of the opposing teeth. If the cusp is short and diminutive, such as **distol**ingual cusps of maxillary molars, DL cusp of maxillary 1st molar should not be considered in the **evaluation**. Great variation in morphology of mandibular 1st premolars, palatal cusps of maxillary 1st **p**remolars should not be considered in the evaluation. If a cusp is out of contact with the opposing rch and the distance is 1 mm or less, then 1 point is subtracted for that tooth. If the cusp is out of contact and the distance is greater than 1 mm, then 2 points are subtracted for that tooth. The width of gauge is 1 mm. If the width of gauge can't be put into the gap, 1 points are subtracted. If the width of gauge can be put into the gap, 2 points are subtracted.



Interproximal Contact :

The mesial and distal surfaces of the teeth should be in contact with one another. If there is interproximal space up to 0.5 mm between two adjacent teeth, then 1 point is subtracted. If more than 1 mm of space is present between two teeth, then 2 points are subtracted. The thickness and width of gauge is only just 0.5 mm and 1 mm, this design will make measuring become easily in this section. If the thickness of gauge can be put into the interproximal space, 1 points are subtracted. if the width of gauge can be put into the interproximal space, 2 points are subtracted.

Occlusal Relationships :

The buccal cusps of maxillary canines, premolars and molars must align within 1mm of interproximal embrasure or mesiobuccal groove of opposing teeth. If the maxillary buccal cusps deviate between 1 and 2 mm from the ideal position, then 1 point shall be subtracted for that tooth. If the buccal cusps of the maxillary premolars or molars deviate by more than 2 mm from ideal position, then 2 points shall be subtracted for each tooth that deviates. When evaluating, face the buccal segment in 90°. Drawing midline of buccal cusps and position of interproximal embrasure, or mesiobuccal groove of opposing teeth, helps diminish the measuring errors. If there is any anterior-posterior discrepancy in occlusal relationships, orthodontists can correct it in time.

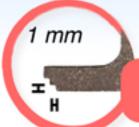
Each step is 1 mm in height for measurement of mandibular buccolingual inclination.

Mandibular Buccolingual Inclination :

1 mm

The buccal cusp (functional cusp) will be in the same level or slightly higher within 1 mm than lingual cusp. If the mandibular buccal cusps are higher more than 1 mm, but less than 2 mm, 1 point shall be subtracted for that tooth. If the **discrepancy is** greater than 2 mm, then 2 points are subtracted for that tooth. The buccolingual inclination of the mandibular posterior teeth shall be assessed by using a flat surface that extended between the occlusal surfaces of the right to left posterior teeth. The measuring gauge must be placed on the palatal cusps of teeth in the same position cross the arch, parallel to occlusal plane as far as possible. If there is large discrepancy in buccolingual inclination, it may cause interference of excrusive movement. Orthodontists can correct it in time.





Each step is 1 mm in height, for measurement of marginal ridge.

Marginal Ridge :

In both maxillary and mandibular arches, marginal ridges of adjacent posterior teeth shall be at the same level or within 0.5 mm of the same level. Place the gauge on the lower marginal ridge of the discrepant area. If discrepancy of marginal ridge is greater than half-step(0.5 mm) but less than 1 step (1 mm) of gauge, then 1 point shall be subtracted. If the marginal ridge discrepancy is greater than 1 mm, then 2 points shall be subtracted. There is greater variation of morphology of mandibular 1st premolar distal marginal ridge of mandibular 1st premolar should not be considered in the evaluation



If there are some discrepancy in marginal ridge, orthodontists can correct it in time.

Each step is 1 mm in height for measurement of maxillary buccolingual inclination.

Maxillary Buccolingual Inclination :

The palatal cusp (functional cusp) will be in the same level or slight higher within 1mm than buccal cusp. If the maxillary palatal cusps are higher than 1 mm, but less than 2 mm, 1 point shall be subtracted for that tooth. If the discrepancy is greater than 2 mm, then 2 points are subtracted for that tooth. There are different grading standards for maxillary 2nd molar. If the discrepancy is greater than 2 mm, then 1 points are subtracted for that tooth. The measuring gauge must be placed on the palatal cusps of teeth in the same position cross the arch, parallel to occlusal plane as far as possible. If there are large discrepancy in the buccolingual inclination, it may cause interference of excrusive movement, orthodontists can correct it in time.

Conclusion :

1 mm

The most effective way to enhance treatment efficiency is to do the correct work at the beginning. It includes accurate diagnosis, optimal treatment planing, working with effective orthodontic system, proper bracket positon, and understanding the treatment mechanics well. After all, during the treatment, we can also follow and check our case with the ABO grading system to monitor if we are heading to the optimal treatment goals by taking x-ray and diagnostic cast. In the beginning of the finishing stage, it is an appropriate timing to take x-ray and diagnostic cast to evaluate with ABO grading system. Make sure to correct all the improper areas that you didn't pay attention to in the process. The ABO grading system make we aware of what mistakes we have made and should be corrected. Correct the mistakes and keep them in mind, we could improve treatment efficiency and also level up the quality of orthodontic treatment results.

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- ABO Case Report -

An Anterior Crossbite and Block-out Canine

HISTORY AND ETIOLOGY

A 9-year and 4-month-old girl with no contributory medical history presented with her parents for orthodontics treatment. Oral examination revealed an anterior crossbite, with block-out right and impacted left maxillary canines. A bilateral Class I molar relationship was present. The upper dentition was severely crowded and the mandibular midline was shifted 1 mm to the left, relative to the facial midline. Both upper 2nd primary molars as well as the lower right 1st and 2nd primary molars were retained. The clinical presentation of the malocclusion suggested an etiology of her malocclusion that was primarily hereditary (maxillary skeletal deficiency); however, the early loss of primary first molars may have been a contributing factor.



Fig. 1 Pretreatment facial photographs



- Skeletal: Skeletal Class III (SNA 79°, SNB 79°, ANB 0°); high mandibular plane angle (SN-MP 40°, FMA 33°).
- Dental: Bilateral Class I molar relationship.
 - Anterior crossbite from canine to canine;
 - 12 mm crowding in the maxillary arch.
 - Block-out right and impacted left maxillary canines.
 - Mandibular midline shift 1 mm left of the facial midline.
- Facial: Straight profile with slightly retrusive upper lip.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla (all three planes):

- A P: Maintain.
- Vertical: Maintain a normal growth pattern
- Transverse: Maintain.

Mandible (all three planes):

- A P: Maintain.
- Vertical: Increase consistent with a normal growth pattern

Fig. 2 Pretreatment intraoral photograph



Fig. 3 Pretreatment study models

Dr. Chris HN Chang, Director, Beethoven Orthodontic Center (middle) Dr. Steven Wu, Lecturer, Beethoven Orthodontic Course (left) Dr. Eugene W. Roberts, Consultant, News and Trends in Orthodontics (right)





Fig. 4 Posttreatment facial photographs



Fig. 5 Posttreatment intraoral photographs



Fig. 6 Posttreatment study models

Transverse: Maintain.

Maxillary Dentition

- A P: Maintain a Class I molar relationship ; procline upper incisors.
- Vertical: Maintain.
- Inter-molar Width: Maintain.

Mandibular Dentition

- A P: Retract lower incisors.
- Vertical: Maintain.
- Inter-molar / Inter-canine Width: Maintain / Maintain. Facial Esthetics: Improve the lip profile.

TREATMENT PLAN

Extraction of four first premolars and retained primary teeth was prescribed. Brackets were bonded on the maxillary molars and incisors. The anterior cross bite was corrected with advancement loops by proclining the upper incisors. Brackets were bonded to the remaining teeth in both arches. Class III elastics were used to correct the anterior and posterior sagittal discrepancies. The growth pattern was carefully monitored with cephalometric radiographs. Spaces were closed with sliding wire mechanics. Vertical (up and down) elastics used to settle the occlusion. Fixed appliances were removed and the corrected occlusion was retained with upper Hawley and lower fixed retainers.

APPLIANCES AND TREATMENT PROGRESS

0.018-in Inspire ICE brackets (Ormco) were used. Four weeks after extraction, upper molars and incisors were bonded and advancement loops were bent into a .014 SS wire to correct the anterior cross bite. Six months into treatment, the rest of the teeth were bonded. The upper extraction spaces were retained with open coil springs to allow for eruption and alignment of the block-out right and impacted left maxillary canines. The wire sequence was as follows: .014 SS, .016

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Fig. 7 Pretreatment pano and ceph radiographs

copper NiTi, .016X22 copper NiTi, .016X22 SS. The Class III elastics were upgraded gradually from 2 oz, 3.5 oz, 4.5 oz to 6 oz respectively. The lower spaces were closed by sliding mechanics with power chains on a .016X22 SS wire. The upper archwire was sectioned distal to the canines one month prior to the completion of treatment. Light up and down elastics (2 oz) were used for final detailing. Appliances were removed and retainers were delivered. Tooth #30 was restored with a metal inlay.

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RESULTS ACHIEVED

Maxilla (all three planes):

- A P: Maintained.
- · Vertical: Increased.

• Transverse: Maintained.

- Mandible (all three planes):
 - A P: Maintained.
 - Vertical: Increased (favorable growth).
 - Transverse: Maintained.

Maxillary Dentition

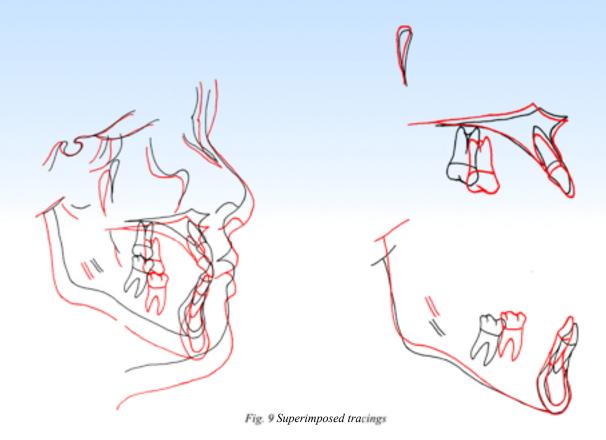
- A P: Protracted.
- Vertical: Maintained.



Fig. 8 Posttreatment pano and ceph radiographs

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA°	80.5°	80.5°	0°
SNB°	79°	81°	2°
ANB°	1.5°	-0.5°	1°
SN-MP°	40°	36°	4°
FMA°	29°	28.5°	0.5°
DENTAL ANALYSIS			
U1 TO NA mm	3 mm	6 mm	0 mm
U1 TO SN°	105°	105°	0°
L1 TO NB mm	5 mm	3.5 mm	1.5 mm
L1 TO MP°	89.5°	81.5°	8°
FACIAL ANALYSIS			
E-LINE	0 mm	-2.5 mm	2.5 mm

Table. Cephalometric summary



• Inter-molar Width: Maintained.

Mandibular Dentition

- A P: Retracted
- Vertical: Increased.
- Inter-molar / Inter-canine Width: Maintained / Maintained.

Facial Esthetics: Improved by increasing lip protrusion.

RETENTION

An upper Hawley retainer was delivered, and the patient was instructed to wear it full time for the first 6 months and nights only thereafter. A lower fixed 5-5 retainer was bonded on every tooth. The patient was instructed on home care and maintenance of the retainers.

FINAL EVALUATION OF TREATMENT

Timely removal of the upper first premolars helped the normal eruption of upper canines and spontaneous resolution of anterior crowding. Careful management of the extraction spaces and proper mandibular anchorage control also enhanced the lip profile. Treatment timing was crucial for Class III correction. In review of the whole treatment sequence, it was apparent that the starting time of the full fixed appliance treatment was too early because the finishing had to be postponed until the eruption of the 2nd molars. It would have been better to use Phase I treatment for the maxillary arch to recover and align the canines, but delay the full fixed appliance (Phase II) until all second molars had erupted. Skeletally, the patient showed a favorable growth pattern without excessive forward mandibular growth. Besides, the growth of her nose and advancement of the lips improved facial harmony. However, the remaining growth potential of her mandible needs to be closely followed. The patient has been monitored for two years after debonding. Now, at the age of fourteen, her occlusion is still Class I and the attractive facial profile has been maintained. She will remain in close follow-up until all facial growth is completed.

DISCUSSION

According to Lin's study¹, anterior crossbite is a common malocclusion in Chinese children. The prevalence of pseudo-Class III malocclusion in Chinese children between age 9 to 15 is 2.31%, and the prevalences of true Class III malocclusion is 1.65%. Because the present patient had a pseudo-class III malocclusion and an orthognathic profile, a



Fig 10. 7th month





Fig 11. 7th month

Fig 14. 24th month





Fig 12. 7th month



Fig 15. 24th month

Fig 13. 24th month

good prognosis is expected according to Dr. Lin's diagnostic philosophy.

An important issue for this patient was the advisability of extraction vs. non-extraction treatment. Extraction treatment facilitates the correction of the 12 mm crowding problem in the upper arch, but complicates the correction of the anterior crossbite. Her straight profile and flat lips initially at the beginning could become dished-in with if the nose and chin become more prominent. There is a good example of this problem in Tweed's textbook². Furthermore, Sarver³ has expressed concern that extraction may cause increased buccal corridors or reduce the possibility of improving them. These issues should be considered before pursuing the extraction plan.

Nonextraction treatment would be challenging for the present patient because correction of 12 mm of crowding in the upper arch by arch expansion would produce severe incisor proclination and/or molar distalization. The lip support and straightly concave profile would be improved with non-extraction treatment, but long term stability would be a concern.

After discussing with the pros and cons with the patient and her parents, an extraction treatment plan produced a favorable result. Superimposed cephalometric tracings revealed that the face grew more vertically than horizontally. That was a favorable growth pattern for achieving a stable anterior crossbite correction. However, nose and chin development was greater than expected. The patient was only 13 years old at the end of treatment, so the growth potential of the nose and chin should be closely monitored in the future.

In contrast, Roberto⁴ reported a favorable long-term follow-up (20 years) evaluation of a patient treated nonextraction who had a similar malocclusion: Class I with a significant skeletal transverse maxillary discrepancy and severe crowding. Therefore, nonextraction treatment for the present patient have been a good treatment alternative.

In conclusion, the review of the entire treatment sequence for the present patient suggested that extraction was the best approach but it would have better to delay full fixed appliance treatment until after puberty. At this time, the patient's growth would be more complete so that a better diagnosis could be accomplished. In addition, treatment time would be decreased because it would not be necessary to wait for eruption of second molars. In any event some early treatment was necessary to make space for the blocked-out canine.

Acknowledgements: Thank Tzu Han Huang, Dr. Sabrina Huang, and Dr. Grace Chiu to proofread this article.

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- 2. Tweed CH. Clinical Orthodontics. Vol. I, II. St Louis, C.V. Mosby Co; 1966. P. 657-70
- 3. Saver DM. Esthetic orthodontics and orthognathic surgery. Saint Louis: Mosby-Year Book; 1998
- Roberto M. A. Lima Filho, DDS, MS: Long-term outcome in a patient with Class I malocclusion with severe crowding treated without extractions. Am J Orthod 2004;126:496-505

DISCREPANCY INDEX WORKSHEET

CASE #	3	PATI	ENT	TING-YING JU
TOTAL D	.I. SCORE		20	

OVERJET

0 mm. (edge-to-edge)	=	1 pt.
1 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
7.1 – 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. per tooth =

Total	=	6
OVERBITE		
0 - 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
Impinging (100%)	=	5 pts.

=

Total



ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth then 1 pt. per additional full mm. per tooth

Total

= 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total



=

=

=

CROWDING (only one arch)

1 – 3 mm.	=	1 pt.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	4 pts.
> 7 mm.	=	7 pts.

Total



OCCLUSION

Class I to end on	=
End on Class II or III	=
Full Class II or III	=
Beyond Class II or III	=

Total

0

0 pts.

2 pts. per side ____

1 pt. per mm.

4 pts. per side _____pts.

additional

pts.

pts.

EXAM YEAR	2009				
ABO ID#	96112				
LINGUAL POSTE	RIOR X-	BITE			
1 pt. per tooth	Total	=		1	
BUCCAL POSTER	RIOR X-E	<u>BITE</u>			
2 pts. per tooth	Total	=		0	
CEPHALOMETR	<u>ICS</u> (Se	ee Instruct	tions))	
ANB $\geq 6^{\circ}$ or ≤ -3	2°		=	4 pts.	
Each degree $< -2^\circ$		_x 1 pt.	=_		-
Each degree $> 6^{\circ}$		_x 1 pt.	=_		-
SN-MP					
$\geq 38^{\circ}$				2 pts.	
Each degree > 38	°2	_x 2 pts	s. =_	4	-
$\leq 26^{\circ}$			=	1 pt.	
Each degree < 26	o 	_x 1 pt.	=_		-
1 to MP $\geq 99^{\circ}$				1 pt.	
Each degree > 99	o 	_x 1 pt.	=_		-
	Tota	al	=	4	

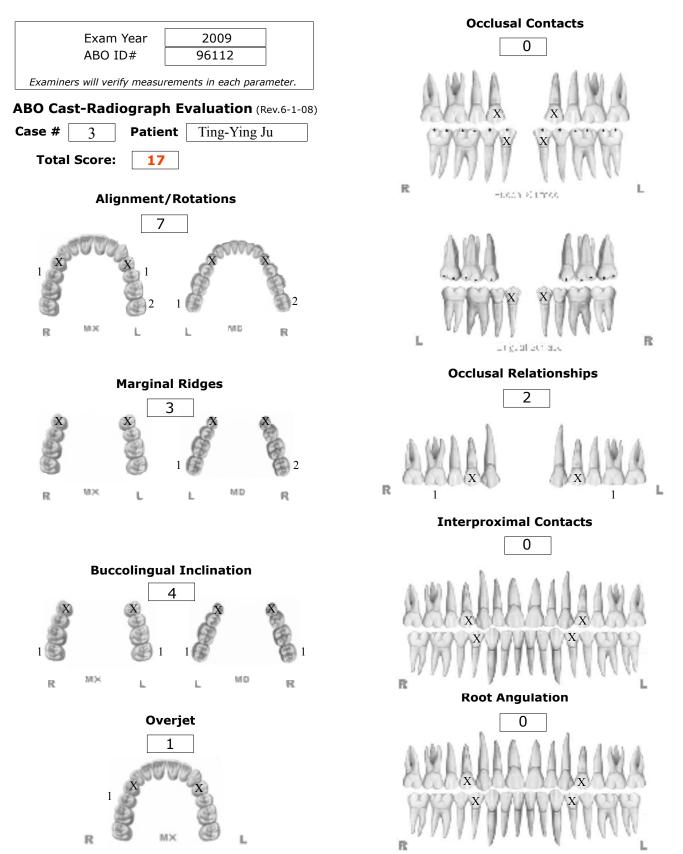
<u>OTHER</u> (See Instructions)

Supernumerary teeth	x 1 pt. =
Ankylosis of perm. teeth	x 2 pts. =
Anomalous morphology	x 2 pts. =
Impaction (except 3 rd molars)	<u>1</u> x 2 pts. = <u>2</u>
Midline discrepancy (≥3mm)	@ 2 pts. =
Missing teeth (except 3 rd molars)	x 1 pts. =
Missing teeth, congenital	<u>x 2 pts.</u> =
Spacing (4 or more, per arch)	x 2 pts. =
Spacing (Mx cent. diastema \ge 2mm)	@ 2 pts. =
Tooth transposition	x 2 pts. =
Skeletal asymmetry (nonsurgical tx)	@ 3 pts. =
Addl. treatment complexities	x 2 pts. =

Identify:

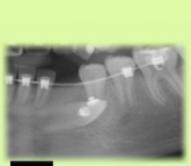
Total

2

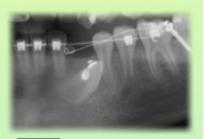


INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

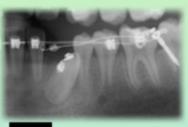
Ø



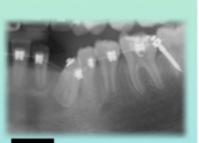
0.7M



2.5M



3.5M



4.5M

OrthoBoneScrew

Corporate Headquarters 2F, No. 25, Jian-Jhong First Road, Hsinchu, Taiwan 300 Tel: +886 3 5735676 Fax: +886 3 5736777 Contact: info@orthobonescrew.com The Dream Screw for Next Generation's Orthodontists



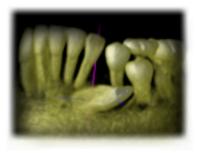
Beethoven Orthodontic Center, Taiwan

OrthoBoneScrew (OBS) has a double-crossed rectangular slot on its neck. This 0.018 by 0.025 inches rectangular slot provides versatile use of orthodontic mechanics. A wire size of 0.017 by 0.025 inches dimensions can be secured in the slot firmly.

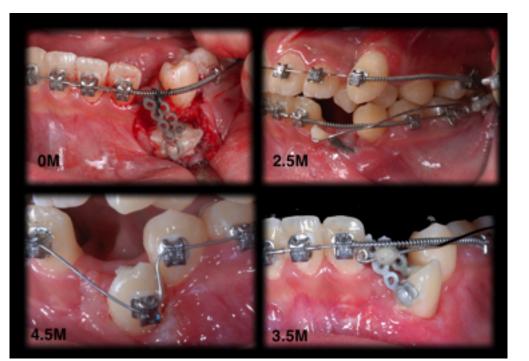
A case report demonstrating a 3D control of impacted canine

Mechanics design:

A 0.017 x 0.025-inch TMA lever arm was consisted of a helical coil on one end and helical attachment on the other end. When this lever arm was inserted in the square hole in the OrthoBoneScrew (located at buccal shelf) and activated, it could build a force system which protracted the tip of canine first, then moved buccally, and finally elevated to the reserved canine space. If the mechanics were designed to exert force



directly from the main arch wire only, it would have been detrimental to the roots of first premolar. During the follow-up visits, the helix was adjusted without taking it out. After three months from operation, the impacted canine was successfully moved away from the previously impacted site and was ready for bracket bonding.



- ABO Case Report -Molar Scissors-bite Correction

A 27-year 5-month-old woman presented with the major concern of crowded teeth and protrusive lips. The patient's medical and dental histories were non-contributory. There were no perioral habits nor significant signs or symptoms of temporomandibular dysfunction.

DIAGNOSIS AND ETIOLOGY

Pretreatment facial photographs showed a straight profile with slightly protrusive lips (Figure 1). The pretreatment intraoral photographs and study models revealed a Class III molar relationship on the right side, and Class II premolar relationship on the left side (Figure 2). Periodontally, the patient had moderate gingivitis, generalized recession, and multiple loss of papillae (black triangles). Tooth #36 (mandibular left first molar) had been extracted for over 10 years ago because of severe caries. The maxillary midline was deviated 3 mm to the right of the facial midline. Cast evaluation (Figure 3) documented the following dental problems: 1. crowding of the upper and lower anterior segments, 2. anterior cross-bite (#32, 41, 42, 43), 3. scissors-bite and extrusion of the maxillary left second and third molars (#26, 27), and 4. Lingually-tipped mandibular second and third molars (#37, 38).

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Cephalometric analysis revealed a skeletal Class I relationship (SNA 82°, SNB 80.5°, ANB 1.5°), a high mandibular plane angle (SN-MP 39°, FMA 35.5°), and asymmetry of the lower border of the mandible. The lower incisor to Md plane angle was 90°. The cephalometric values are summarized in the Table. The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 25, as documented by the DI worksheet.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla :

- A P : Maintain.
- Vertical : Maintain.



Fig. 1 Pretreatment facial photographs



Fig. 2 Pretreatment intraoral photograph

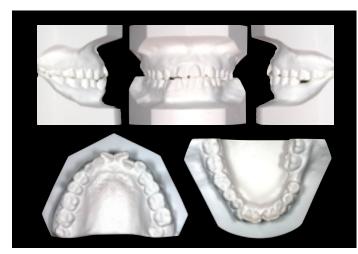


Fig. 3 Pretreatment study models

ABO CASE REPORT NTO 16

Dr. Chuan-Wei Su, Lecturer, Beethoven Orthodontic Course (right) Dr. Chris HN Chang, Director, Beethoven Orthodontic Center (middle) Dr. W. Eugene Roberts, Consultant, News and Trends in Orthodontics (left)





Fig. 4 Posttreatment facial photographs



Fig. 5 Posttreatment intraoral photographs

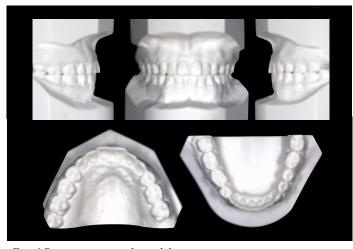


Fig. 6 Posttreatment study models

• Transverse : Maintain.

Mandible :

- A P : Maintain.
- Vertical : Increase.
- Transverse : Maintain.

Maxillary Dentition :

- A P : Midline correction, retract incisors and protract the right posterior segment.
- Vertical : Maintain.
- Inter-molar Width : Maintain.

Mandibular Dentition :

- A P : Retract incisors and protract the left posterior segment.
- Vertical : Align and intrude the lower left molars. Maintain the right posterior segment.
- Inter-molar / Inter-canine Width : Upright the lower left side molars.

Facial Esthetics : Reduce lip protrusion.

TREATMENT PLAN

Both upper first premolars and the lower right first premolar were extracted (#14, 24 and 44). A full fixed orthodontic appliance was used to correct bimaxillary protrusion, relieve anterior crowding, coordinate the arches, and improve the soft tissue profile. An interradicular miniscrew between #37, 38 provided anchorage to intrude and align the mandibular left molars. Another miniscrew was inserted above the upper left mucogingival junction in the molar area for midline correction, anterior segment retraction, and intrusion of supra-erupted molars. Intermaxillary elastics were used to correct the sagittal discrepancy and the occlusion was detailed with finishing bends. Fixed appliances were removed and the occlusal correction was retained with a lower anterior fixed retainer in conjunction with upper Hawley appliance.



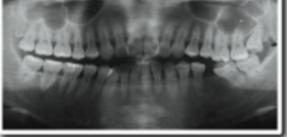


Fig. 7 Pretreatment pano and ceph radiographs

APPLIANCES AND TREATMENT PROGRESS

After extraction of #14, 24 and 44, a 2.0 x 8 mm miniscrew, Micro-Implant Anchorage (MIA) was placed into the inter-radicular region between the lower left second and third molars to correct the buccal cross-bite. Another miniscrew (2.0 x 10 mm) was implanted at the mucogingival junction of the mesial aspect of the edentulous ridge of lower left first molar area to serve as anchorage for lower left molar protraction. After one month, both arches were bonded with standard 0.018-in Edgewise brackets (Roth). The archwire sequence was .014 copper NiTi, progressing to heavy rectangular .016 x .022 SS. Seven months after the buccal cross-bite was corrected, the lower left posterior segment was protracted with miniscrew anchorage by sliding the molars along a .016 x .022 SS wire. Twelve months into active treatment, 3/16 inch (6 oz) heavy elastics were applied from the lower canines to upper molars for Class III canine relationship correction. To minimize dark triangles, interproximal enamel width was reduced with a high speed fissure bur and the spaces were closed with power chain. A progress panoramic radiograph was taken to evaluate the relationship between axial inclination and bracket position for each tooth.

In the 24^{th} month of treatment, another miniscrew (2.0 x 10 mm) was inserted at the mucogingival junction of the



Fig. 8 Posttreatment pano and ceph radiographs

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA°	82°	82°	0°
SNB°	80.5°	80°	0.5°
ANB°	1.5°	2°	0.5°
SN-MP°	39°	41°	2°
FMA°	32°	34°	2°
DENTAL ANALYSIS			
U1 TO NA mm	7 mm	4 mm	3 mm
U1 TO SN°	106.5°	101°	5.5°
L1 TO NB mm	7 mm	4 mm	3 mm
L1 TO MP°	90°	83°	7°
FACIAL ANALYSIS			
E-LINE (U)	2 mm	-1 mm	3 mm
E-LINE (L)	3 mm	0 mm	3 mm

Table. Cephalometric summary

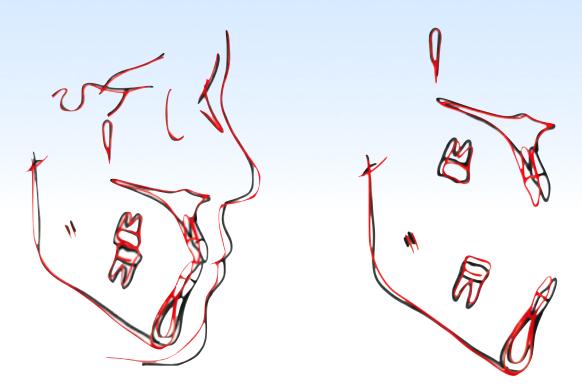


Fig. 9 Superimposed tracings

upper left molars for correction of the intermaxillary midline. The upper archwire was sectioned distal to the cuspids one month prior to the completion of treatment. Light vertical elastics (2 oz) were used for final detailing. Appliances were removed and retainers were delivered.

Figures 4-6 reveal the improvement in facial form, dental alignment and favorable periodontal response. Comparison of the pretreatment (Figure 7) and posttreatment (Figure 8) cephalometric and panoramic radiographs document the desirable outcome in facial and intermaxillary alignment. The cephalometric table compares the pretreatment and post-treatment measurements. Figure 9 is a series of cephalomeric tracings superimposed on the anterior cranial base, maxilla and mandible. Figure 10 shows the initial mechanics to intrude and move the left mandibular molars buccally. Figure 11 is 7 months of progress utilizing the miniscrews for anchorage. The mechanics associated with the use of a cross-elastic (Figure 12) is compared to the anchorage achieved by a mandibular buccal miniscrew (Figure 13). Thirteen months into active treatment, intermaxillary elastics are used to

correct the anterior crossbite tendency (Figure 14), and the closure of the lower left space is documented at 23 months (Figure 15). At 24 months the maxillary midline is corrected with anchorage from an upper left miniscrew (Figure 16). Figure 18 shows the 2 mm interdigitation discrepancy in the left buccal occlusion. The mesial in rotation of the lower left first molar is shown in Figure 18. The orthopedic and dental results are summarized below.

RESULTS ACHIEVED

Maxilla :

- A P : Maintained.
- · Vertical : Maintained.
- Transverse : Maintained.

Mandible :

- A P : Maintained.
- Vertical : Increased.
- Transverse : Maintained.

Maxillary Dentition :

- A P : Anteriors retracted Posteriors slight protracted.
- Vertical : maintained.



Fig 10. Implant miniscrew between 2^{nd} and 3^{rd} molar. One orthobonescrew was implanted at the mucogingival junction of the edentulous ridge of lower left first molar area.

- Inter-molar Width : maintained.
- Mandibular Dentition :
 - A P : Anteriors retracted.
 - Vertical : Increased.
 - Inter-molar / Inter-canine Width : Increased.

Facial Esthetics : protrusive lips corrected.

RETENTION



Fig 11. After / months, buccal crossbile were corrected. The orthobonescrew, placed in the middle of edentulous ridge can be demonstrated that the bone was moved with the lower teeth.

The patient was instructed to wear an upper Hawley retainer full time for the first 6 months and nights only thereafter. The lower 4-4 fixed retainer was bonded on each tooth. The patient was instructed about home care and maintenance of the retainers.

FINAL EVALUATION OF TREATMENT

The overall results were acceptable, thanks in part to excellent patient cooperation with lip training,

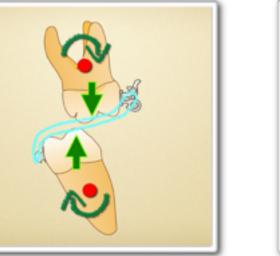


Fig 12. Criss-cross elastics can be used to simultaneously upright a lingually tipped lower second molar and a buccally tipped upper second molar, but they generate lingual and extrusive forces on the upper molar and buccal and extrusive forces on the lower molar.



Fig 13. Miniscrew place in the alveolar bone buccal to the lower molar generate buccal and intrusive forces on the lower molar.



Fig 14. 13 *M* during tx., ¹/₄ inch 3.5 ox Fox, U6-L3





Fig 15. 23 M during tx, extraction space of #36 was closed.

intraoral elastics and optimal oral hygiene. Facial harmony and lip closure were improved (Figure 4). Post-treatment intraoral photographs and study casts (Figures 5 and 6) showed a Class I molar and canine relationship on the right side. A Class II molar relationship on the left side resulted from extraction of upper right first premolar without removing a mandibular premolar. The upper dental midline was corrected, and an ideal overjet and overbite were achieved.

Cephalometric analysis (table) and superimpositions (Figure 9) showed no skeletal changes in the maxilla or the mandible. The upper incisor to the SN angle decreased from 106.5° to 101°. The lower incisor to the Md plane angle decreased from 90° to 83°. The SN-MP angle increased from 39° to 41° because of bite opening associated with correction of the posterior scissors-bite. Critical assessment of dental alignment with the ABO cast and panoramic radiograph method showed the following deviations from ideal: 1. Mesial in rotation of maxillary lateral incisors, 2. Excessive mesial rotation of mandibular right second and left first molars, 3. Marginal ridge discrepancies (#15-16, 25-26 and 36-37), 4. Maxillary right canine and second premolars were 2 mm Class II, 5.



Fig 16. 24 M during tx, orthobonescrew was placed at the mucogingival junction of the upper left molars for correction of the intermaxillary midline.

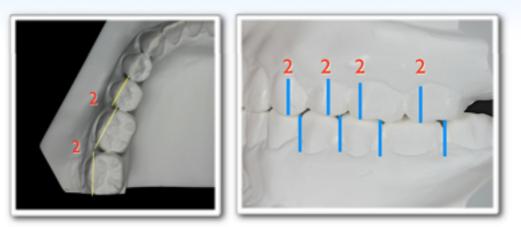


Fig 17. The mandibular left first molar exhibited excessive mesial rotation.

Fig 18. The buccal cusps of the upper right canine and second premolar, and mesiobuccal cusps of the upper right first and second molars were shifted over 2 mm relative to the interproximal e m b r a s u r e s of t h e mandibular posterior teeth.

Mesiobuccal cusp of the left maxillary second molar was 1.5 mm shifted from an ideal relationship.

The total score for the cast and panoramic radiograph grading system was 26, as shown on the Objective Grading System (OGS) worksheet. This is the maximal allowable score to be considered a board quality result.

DISCUSSION

Scissors-bite¹ is characterized by labial eruption of the upper molar and/or lingual tipping of the lower molar and and may be associated with an arch-length discrepancy in the posterior region. Scissors-bite is observed most frequently in the second molar region. Several treatment procedures have been proposed to treat scissors-bite in the molars: intermaxillary cross-elastic, multi-bracket appliance, transpalatal arch appliance (TPA) and/or lower lingual arch (LLA) with an intramaxillary elastic. However, all of these methods generate extrusive forces on the second molars in both jaws and might induce an undesirable decrease in overbite, clockwise rotation of the mandible, and premature contact. In addition, treatment results depend on patient cooperation, if an intermaxillary elastic is used (Figure 12).

Recently, miniscrews have been used as a method of skeletal anchorage because they can be inserted easily into various positions with a less invasive, simpler surgical procedure, and offer sufficient anchorage stability². Park, Yun and colleagues³ reported the use of miniscrew anchorage for the correction of scissors-bite by intrusion of the upper and lower second molars. The scissors-bite in the present patient was associated with mandibular plane asymmetry and extrusion of molar in both arches. Insertion of a miniscrew into the interradicular space between lower 2nd and 3rd molars achieved skeletal anchorage to correct the molar scissors-bite in 7 months (Figures 10 and 11).

A miniscrew placed in the alveolar bone buccal to the mandibular molars can provide both buccal and intrusive force, without any other orthodontic appliances as anchorage³. A temporary bite plate or bite turbo may be necessary to avoid occlusal interference during cross-bite correction (Figures 10 and 13). The clinician should be careful to avoid rotation of the molars during scissors-bite correction.

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- Kuroda S et al: Clinical Use of Miniscrew Implants as Orthodontic Anchorage: Success rates and Postoperative Discomfort. Am J Orthod Dentofacial Orthop. 2007; 131:9-15
- Park HS et al: Uprighting Second Molars with Micro-implant Anchorage. J Clin Orthod. 2004; 38:100-103

DISCREPANCY INDEX WORKSHEET

CASE #		PA	TIENT
TOTAL D	I. SCORE	Ē	25

OVERJET

0 mm. (edge-to-edge)	=	1 pt.
1 - 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
7.1 – 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. per tooth =

OVERBITE

Total

0 – 3 mm. 3.1 – 5 mm. 5.1 – 7 mm. Impinging (100%)	= = =	0 pts. 2 pts. 3 pts. 5 pts.
Total	=	0

ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth then 1 pt. per additional full mm. per tooth

Total



4

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total



CROWDING (only one arch)

1 – 3 mm. 3.1 – 5 mm. 5.1 – 7 mm. > 7 mm.	= = =	1 pt. 2 pts. 4 pts. 7 pts.

Total



OCCLUSION

Class I to end on End on Class II or III Full Class II or III Beyond Class II or III	= = =	0 pts. 2 pts. per side <u>pts.</u> 4 pts. per side <u>pts.</u> 1 pt. per mm. <u>pts.</u> additional
Total	=	6

EXAM YEAR					
ABO ID#]	DATE	
LINGUAL POSTER	IOR X-	<u>BITE</u>			
1 pt. per tooth	Total	=		0	
i pi. poi tootii	Totul			0	
BUCCAL POSTERI	OR X-E	BITE			
2 pts. per tooth	Total	=		4	
CEPHALOMETRIC	<u>'S</u> (Se	ee Instruc	tions))	
ANB $\geq 6^{\circ}$ or $\leq -2^{\circ}$			=	4 pts.	
Each degree $< -2^{\circ}$		_x 1 pt.			
Each degree $> 6^{\circ}$		_x 1 pt.			
SN-MP					
$\geq 38^{\circ}$			=	2 pts.	
Each degree $> 38^{\circ}$	1	x 2 pts	s. =	2	
		_ 1			
$\leq 26^{\circ}$				1 pt.	
Each degree $< 26^{\circ}$		_x 1 pt.	=_		
$1 \text{ to MD} > 00^{\circ}$			_	1 nt	
1 to MP \geq 99°				1 pt.	
Each degree $> 99^{\circ}$		_x 1 pt.	=_		
	Tot	al	=	4]

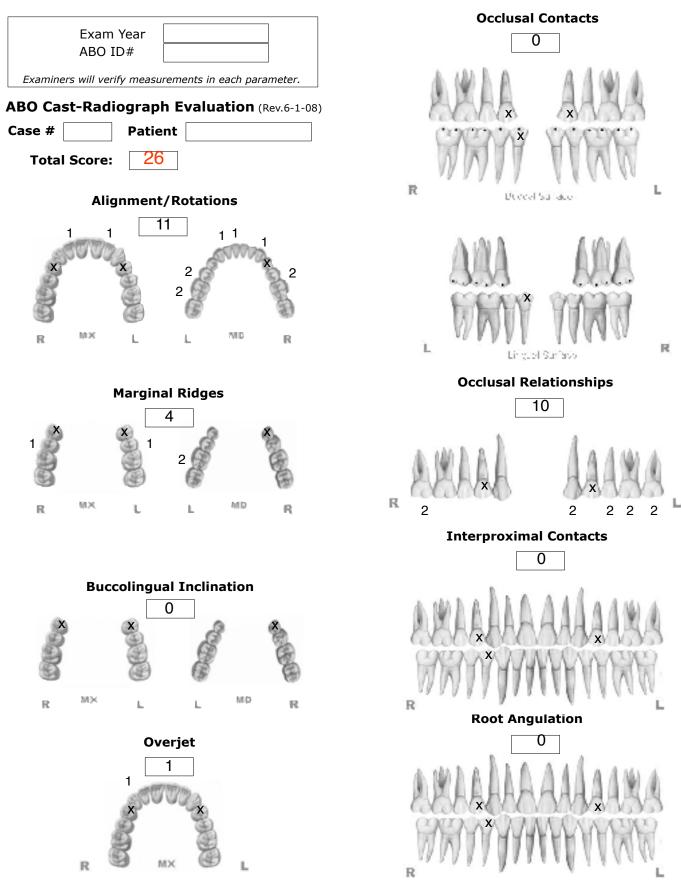
<u>OTHER</u> (See Instructions)

Supernumerary teeth	x 1 pt. =
Ankylosis of perm. teeth	x 2 pts. =
Anomalous morphology	x 2 pts. =
Impaction (except 3 rd molars)	x 2 pts. =
Midline discrepancy (≥3mm)	@ 2 pts. =
Missing teeth (except 3 rd molars)	x 1 pts. = 1
Missing teeth, congenital	x 2 pts. =
Spacing (4 or more, per arch)	x 2 pts. =
Spacing (Mx cent. diastema \geq 2mm)	@ 2 pts. =
Tooth transposition	x 2 pts. =
Skeletal asymmetry (nonsurgical tx)	@ 3 pts. =
Addl. treatment complexities	x 2 pts. =

Identify:

Total

= 1



INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

iPod touch

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	系列三: 簡潔有效的錨定系統	系列九: 軟硬組織及診斷分析 (2)
	系列四: 不拔牙與拔牙分析	系列十:兒童矯正及診斷分析 (3)
	系列五: Damon 診斷流程及微調	系列十一:成人矯正及診斷分析 (4)
	系列六: 生物力學及完工檢測	
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	系列三:Bond 與相關衛教 / 辨認 Damon 線 / Damon 應對 Q & A	
5	F. 有聲精修視訊課程系列:	售價:14,300元
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Feedback from the 6th Beethoven International Damon and OrthoBoneScrew Workshop



D This is an advanced course in orthodontic bone screw application. For those who want to upright molars and move transposed canines into their ideal position or who want to visit a highly productive and efficient clinic, this is the first choice.

Dr. Chiong Weng Lee (Malaysia)



2 It was truly a well organized and well taught course. All objectives were clearly met. In addition, the visit to the clinic and seeing the systems at work was priceless. A world class course.

> Dr. Yap Yi Roon, Ronnie (Singapore) Orchard Scotts Dental Center for Advanced Dentistry

Dear Chris and Shu Fen:

In all my years involved in orthodontics, I have not seen any practice run as seamlessly as your does. To work with so *many patients in one session—to deal* with such a variety of complex and unique malocclusions, to combine all photography, records etc in to the consult on the same day *—and still make each person in your clinic feel special—is an absolute gift in every* sense. You and your team are simply the best *I have ever seen—and It is such a pleasure to* be associated with you all even in a small way. Thank you for enabling me to experience what you do—with the exception of my visit to Dr. Damon's practice—my visit with you was the highlight of my career.





Ź



OrthoBoneScrew and Damon workshop

includes two half-day lectures, two half-day chairside observation sessions, one model practice and one case discussion session. Cost: USD 1,200 Next dates: August 14-16; December 7-9

Keynote Presentation workshop

includes a total of 6.5-hours of lecture and hands-on practice, focusing on improving your professional communication skills. The workshop will use Macintosh computers and its native presentation software, Keynote 09. Cost: USD 300

Contact: Ms. Huang thhuang@newtonsa.com.tw



The visit to Beethoven and Newton's A center of this time was really an eve-opening experience for me in many ways. Among others, what impressed me the most was the confidence of staff members at work. Of course, it must be the consequence of a superb office management system. A lot of time and effort must have been poured in to establish the current status, which is well rewarded.

Being inspired by the visit to Hsinchu, I have come back to my office with several new ideas to improve my own office system.

It was also a fun to get acquainted with some new friends from Thailand, Malaysia and Vietnam. Thank you very much for the wonderful and refreshing 2 days. I want to return some day with my staff members to show them how efficient an orthodontic office can be.



Dr. Tomio Ikegami, Japan (middle) President of the Japan MEAW Technique and Research Foundation

Beethoven International Damon and OBS Workshop LECTURER: Dr. John Lin his PhD in bone physiology and Certificate in Orthodontics from Indiana University in 1996. President of the Jin-Jong Lin As publisher of News & Orthodontic Clinic. Dr. Lin received

his MS. from Marquette University and is an internationally renowned lecturer. He's also the author of Creative Orthodontics and consultant to News and Trends in Orthodontics.

LECTURER: Dr. Chris Chang

President of the Beethoven Orthodontic Center. He received

Trends in Orthodontics, he has been actively involved in the design and application of bone screws.





高醫牙 曾千芸

高醫牙 吳尚恆

1. 經過這次的見習活動讓我對於矯正跟兒牙方面有更深入的了解,也學習到 其他不同的診療方法,是很豐富有趣的經驗!

2. 十分有收穫的三天,豐富的內容,有趣的簡報,建議可以分梯次舉辦,減 少每梯人數可讓過程更有效率感謝貝多芬這次的熱誠!

3. 感謝這三天為我們安排活動的思涵小姐以及各診所親切可愛的牙助小姐, 當然最感謝提供這次活動的張醫師, It is amazing !Thank you!



這是我參加過最不一樣的見習活動。第一次看到這樣一位享譽國內、登 上國際舞台的矯正醫師,願意花時間教導我們、提攜我們晚輩;第一次看到 一個牙醫診所,沒有刺眼的頭燈、狹小的隔間,而且每位助理都可以一直保 持笑容,還稱呼我們"醫師",甚至願意停下手邊工作,只因為要聆聽我們的 問題,讓我備受禮遇、深受感動。

這幾天,不管是在金牛頓、安徒生、或貝多芬,我都可以感受到一致的風氣,那就是熱心、開朗、禮節、服務精神。我覺得張醫師以及所有的工作團隊,儼然成為一個大家庭,每個人都帶著貝多芬"集團"特有的氣質與魅力,或許有其老闆,必有其員工吧。



國防牙 蔡志雄

感謝貝多芬診所提供這麼好的學習機會,三天兩夜的活動裡對我來說收 穫最多的是在見習課看到張醫師能在短短的數分鐘內為病人及家屬剖析病 情,當中醫病關係的建立,要是我是病人也會笑嘻嘻的拿著錢拜託張醫師幫 幫忙!

對於 Keynote 及 Pages 部分,也許是因為 PPT 的製作對我們來說並不是 太困難的方式,所以教學的部分稍嫌簡單一些。如果可能增加然我們實際看 到更多 Keynote 的成品,我想這更能大大的改變我老牌的 PPT 製作方式。

至於貝多芬的經營管理才是最值得細嚼慢嚥的部分,一天只工作五小時 的超品質生活,看見小姐怎麼熱愛他們的工作,大紙條上密碼代號的溝通模 式簡單而精準有效率。







獎學金見習心得 PART 1

4

北醫牙 古佳怡

金牛頓 Pages 和 Keynote 教學:

我從六歲就開始使用電腦,也許這對這個時代的小孩一點都不稀奇,因為新 新人類都是從受精卵開始,就聽媽媽 MSN 敲鍵盤的聲音長大,但是我當時是用 可是 DOS 系統,在姊姊身後看一大堆開機指令,看到什麼就偷偷背起來,白天 一到,等姊姊出門,我都會在家依樣畫葫蘆,偷偷把電腦打開,開始玩 window 95 的接龍遊戲,後來電腦進化非常快速,完全不需要 DOS 繁雜的指令,就可以 自動開機作業,還多了踩地雷的遊戲,國小的時候就用我那快速的手指打破紀 錄,把姊姊電腦踩到當機,所以理論上我玩電腦也是有二十多年的經驗囉!但是 卻是第一次使用 Mac,而我的「第一次」就獻給了金牛頓,阿不對,是金牛頓送 給我這麼寶貴的一課,經過這幾天的學習,Mac 有多好用?已經不需要我們多做 說明,真的好到沒話說,讓呆板 PPT 活了起來,縮短我們編輯的時間,增加做事 情的效率。謝謝金牛頓所有的工作人員,尤其是最辛苦的 speakers,因為有你們 詳細說明與指導,讓我們很快就有感覺,馬上就能學會操作的方法。最要感謝就 是張醫師非常有遠見,Keynote 實在是太棒了,不但美觀,讓觀眾一目了然,不 再昏昏欲睡,馬上能抓到重點。



安徒生:

三位厲害的女醫師集思廣益,一步一步讓兒童牙科診所能在一個月開幕,真的很了不起。聽著安徒生的故事,讓我彷彿又回到童年的時光,一閃一閃的火柴棒,搭配國王的新衣,三個女人意想不到的火花,創造出自己獨特的風格,成就一家成功的兒童牙科診所。經過一個下午的觀摩,深深體會到三位醫師帶著著滿滿的愛心,對小朋友有超大尺度的耐心,還有配合度超高完全又不哭鬧尖叫的小朋友,讓我們大開眼界。

貝多芬矯正中心:

診所內所有的助理們不但親切又可愛,還有非常高超的拍照技術,動作超迅速,使命必達!謝謝你們教我 們拍口內口外照,還幫忙整理列印出來送我們當紀念品,診所一定要有超高效率的你們,才會如此的成功。 謝謝張醫師讓我有機會參觀貝多芬矯正中心,雖然中壢人不是很聰明,但是能在貝多芬畢業真的收穫良多。 原來,矯正可以很複雜,但是也可以很簡單。如果我是病人,也會想要選擇最簡單最快速的方法,讓自己更漂 亮。矯正這門大學問,學校只能給我們學生一個大概的雛形,沒有臨床實務很難完全瞭解。三天的見習,體驗 到貝多芬是很有組織,每個環節都很重要,按照不斷修正的SOP,讓診所經營運作更有效率,而且也能讓病人 減少不必要的等待。



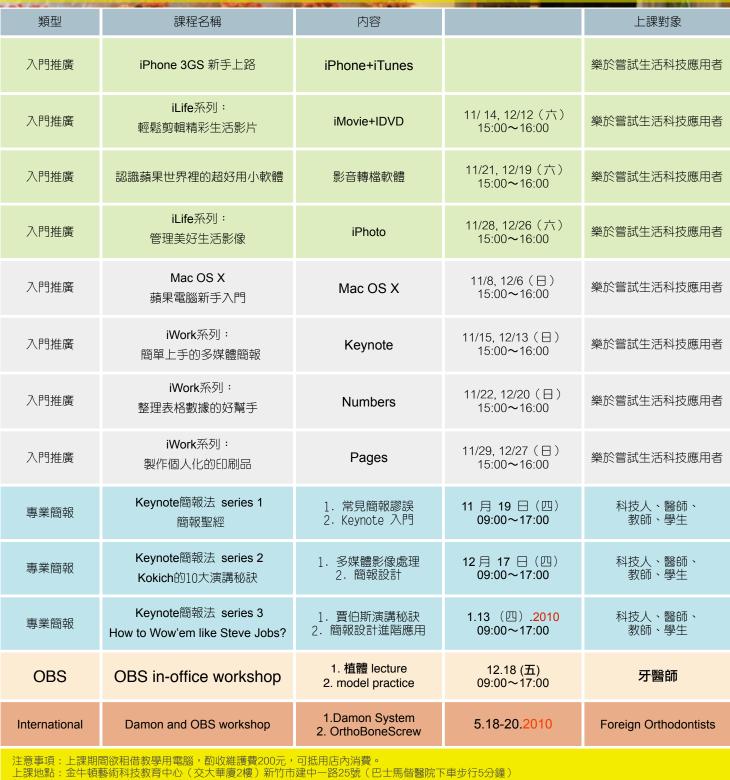
北醫牙 涂世杰

身為牙醫學系的學生,對於這次的見習活動,印象最深刻與最感到 amazing 的就是在貝多芬矯正中心跟診的時間了。在上學期的矯正課程中,主授林利香老 師與林錦榮老師都曾在課堂中略微提及 TADs 與 Damon 矯正器,而在診所見習 時親自看到張醫師種植 OrthoBoneScrew 的示範與張醫師美式矯正診所的獨特, 除了加強上學期學到的內容外,更是讓我真正覺得擴展了視野。張醫師幽默的演 講方式與內容,與潛藏在雙眼中、並略微透露在幽默話語中的那種智慧,真的讓 我相當的欽佩。除了張醫師的指導與提供的機會外,另外也很感謝蕭醫師在我們 跟診過程中給予我們親切的指導與建言。張醫師曾與我們提及「觀察力的重要 性」,我想這是除了演講中談到的 free body 觀念外,最讓我印象深刻的話了。 謝謝張醫師、金牛頓與貝多芬的各位醫師、助理與工作人員,謝謝你們給我們這 個可貴的學習機會!





Winter



al 1686 45

報名專線:03-5735676 黃小姐 金牛頓網頁: <u>www.newtonsa.com.tw</u>

one size fits au Ortho Bone Screw

L: Buccal Shelf

OrthosoneScrew in-office Workshop

 12/18 (五)
 10 小時 lecture + hands - on練習 + 臨床觀摩時間

 9:00 ~ 12:00 植體時機、植法、正確使用、雜症排除

 14:00 ~ 15:00 model 操作

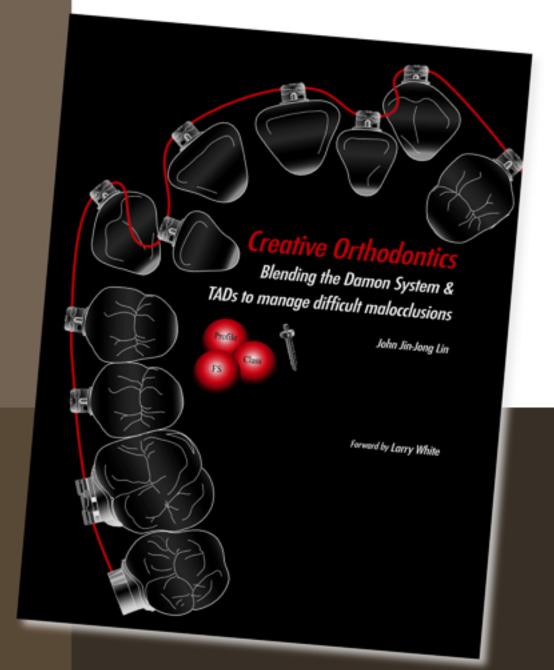
15:00~20:00 植法及用法實習

新竹貝多芬齒顎矯正中心負責人 <u>美國印第安那普渡大</u>學齒顎矯正研究所博士

講師 張慧男 博士

"An excellent instructive and reference text for postdoctoral orthodontic students and specialist clinical orthodontists. Definitely recommended reading!"

-Alex Jacobson, associate editor of AJODO





2009 Beethoven 6th International OrthoBoneScrew and Damon Workshop