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Wedgewise – Improving on Edgewise

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Summary: Not Just Another Self-Ligating Bracket!

The Wedgewise method as expressed by the Triamond appliance, resolves the shortcomings of the rectangular slot brackets. In doing so, it permits lighter forces to be used in directing tooth movement, reduces biomechanical side effects, and provides a method of early initiation of first, second and third order movements. These characteristics of Wedgewise combine to potentiate a more biologically sound method of tooth movement (due to lower applied forces and elimination of uncontrolled tipping movements), and a more efficient treatment path (due to biomechanical predictability and expression of the appliance prescription). Hence, reduced treatment duration can be anticipated which can benefit patients (reduced risk of root resorption, enamel decalcification etc.), and practitioners (fewer tasks throughout treatment with fewer appointments required to complete shorter treatments).

Furthermore, the Triamond brackets were proactively designed to be incorporated into a modern orthodontic practice with emphasis on their exceptionally simplistic usage. Given that only 2 sets of arch wires are required throughout the entire course of treatment, and that the clip mechanism is highly reliable and easy to manipulate, makes this appliance very practical in a team environment where clinical tasks are delegated. In addition, a very small armamentarium is required to perform the minimal tasks required in utilizing this tool in clinical practice. A detailed description of the protocol recommended in Wedgewise will be described in an ensuing article.

I respectfully leave it to the reader to connect the triangles as to the impact this paradigm shift will have on their appointment "book" and finances. To further emphasize the advantages of Wedgewise and the potential of the Triamond® brackets, several clinical cases are detailed below.

Looking back…

The Edgewise Appliance has been the treatment tool of choice soon not long after Angle developed and introduced it in 1925.[1-6] The use of variants based on this technique is part of every Orthodontic department's curriculum and the clinical training this entails revolves around the anticipation and compensation of the shortcomings of this ingenious appliance. Its current use as a preadjusted directly bonded appliance engaging arch wires composed of various alloys has simplified its chairside handling, but its efficiency in the overall duration of treatment has remained unchanged for a century.[7] This should give us pause to consider if perhaps this condition can be improved, given the rate of advances in other fields of medicine. An appliance which, in a simplified manner, reduces treatment duration while requiring lower levels of force application and do so in a simple clinically efficient manner would surely have been Angle's next invention after Edgewise.

Moving ahead…by 40-60%

Presently, a new category of orthodontic mechanism will be presented – Wedgewise. This paradigm shift in orthodontic therapy addresses the detrimental issues of the mechanically-oriented approach of its predecessor, which itself resulted from an evolving process of device development.[8] Furthermore, our improved understanding of the biology of tooth movement and the conditions caused by the Edgewise Appliance requires that we resolve the disparities of these converging disciplines.[9]

Wedgewise has mechanical advantages over Edgewise during all aspects of tooth movement because of its differences in design. For this purpose, the Triamond bracket was developed possessing a unique slot geometry enabling treatment to be administered using 2 sets of "light" arch wires. In addition, the self-ligating clip complements the mechanotherapy by generating force vectors unlike any other ligating method. This combination results in the easiest bracket existing to use clinically and reduces 40-60% of treatment duration typically experienced using any Edgewise / rectangular slot appliance. This has been a consistent observation in clinical tests with hundreds of cases. Furthermore, the biomechanics and clinical outcomes become more predictable.

Geometry for superior clinical results

Whereas, all Edgewise brackets possess a 3-walled, right angled, rectangular arch wire slot, the Triamond® bracket is designed with a 2-walled triangular depth of slot which engages a square wire rotated 45^0 so that it is “wedged” into it (Fig. 1).

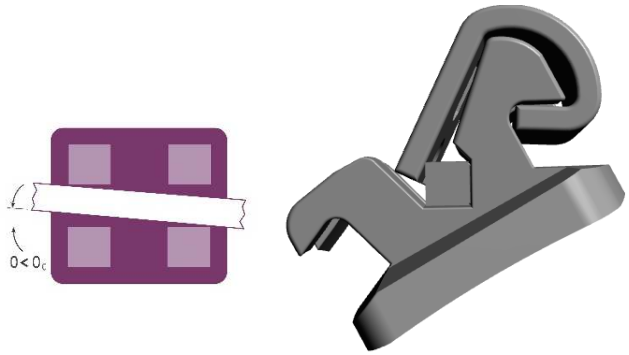


Fig. 1: Profile view of Triamond® bracket engaging the Wedgewise wire. Note the corresponding fit between the slot and the arch wire as opposed to an Edgewise bracket.

The complementary fit of the Wedgewise slot and wire eliminates arch wire binding/notching at the slot edges with its associated friction and elevated force requirement, strain on anchorage and dental “jiggling” all of which characterize tooth movement using an Edgewise appliance, and unnecessarily prolong orthodontic treatment.

The unique triangular slot together with the self-ligating clip of the Triamond bracket ensure that the arch wire remains fully seated without slot-play or “slop”. This is the inverse of what occurs to varying degrees with all arch wires in Edgewise and the source of its aforementioned detriments. Furthermore, tooth movement as expressed in Edgewise is typically initiated by crown movement in the direction of the applied force while the root apex is displaced in the opposite direction. This continues until diagonally opposed corners of the slot engage the wire, causing its cessation and initiation of root movement now in the direction of the force applied at the bracket. Meaning, that the initial stage of tooth movement causes the crown and root to move in opposite

directions (*a.k.a.* uncontrolled tipping) until a moment is generated to reverse this process. This method of tooth movement generates oscillating and alternating zones of compression and tension along the dental root (Fig. 2a,b), which implies not only a waste of energy translated into longer treatment, but may increase the risk of iatrogenic results.[9]

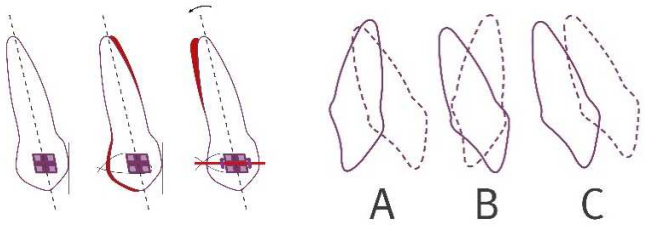
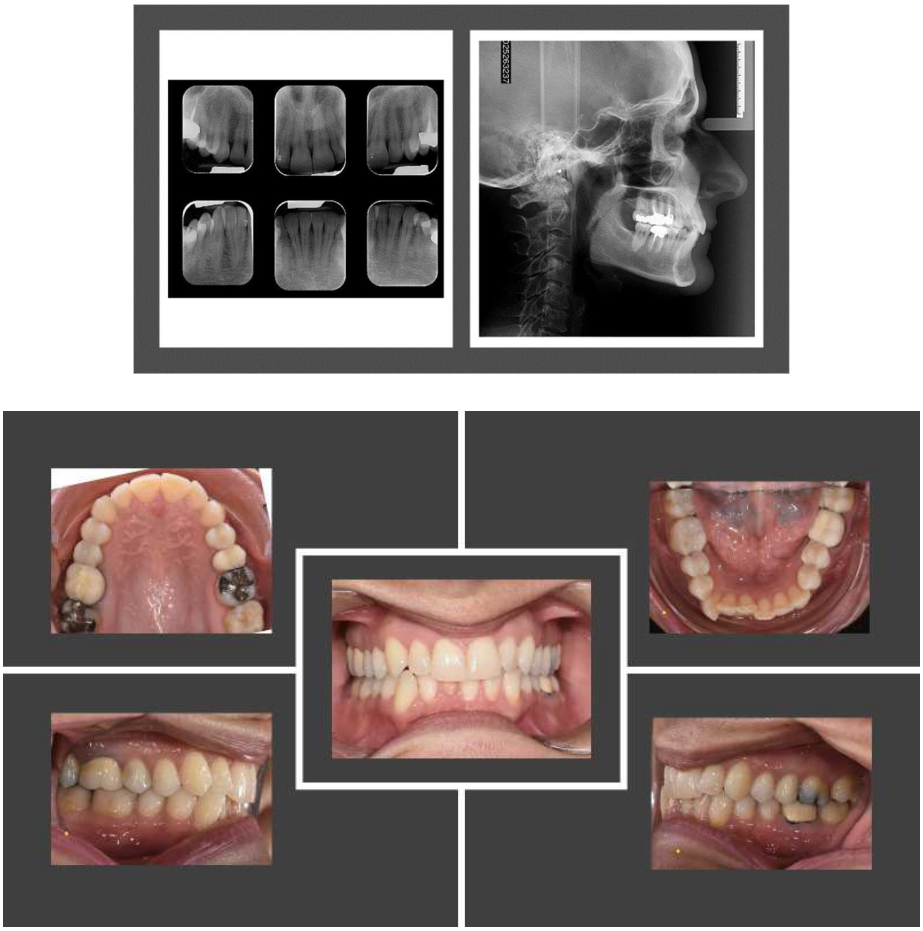


Fig 2: (a) Alternating crown and root movement that occurs in Edgewise *"jiggling"* (A+B=C), (b) Gradients of reversing areas of compression (in red) in PDL as tooth moves using the Edgewise technique

Attempts to nullify this "micro-jiggling" during tooth movement include unrealistic attempts to pinpoint an appropriate moment-to-force ratio,[10,11] creating couples using slot angulations or inter-bracket wire bending to offset the moment caused by the applied mechanical force,[12-15] or the near as possible filling of the arch wire slot within the Edgewise brackets. However, "the biomechanical concept of translation can only exist instantaneously, and cannot be sustained over time with any *existing appliance system* (emphasis added)."[16] and increasing further the friction expressed by the Edgewise appliance only serves to require that greater forces be applied to overcome it.[17]

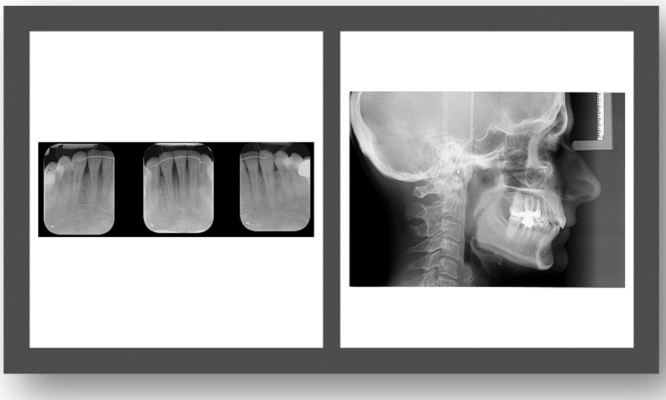
Case 1

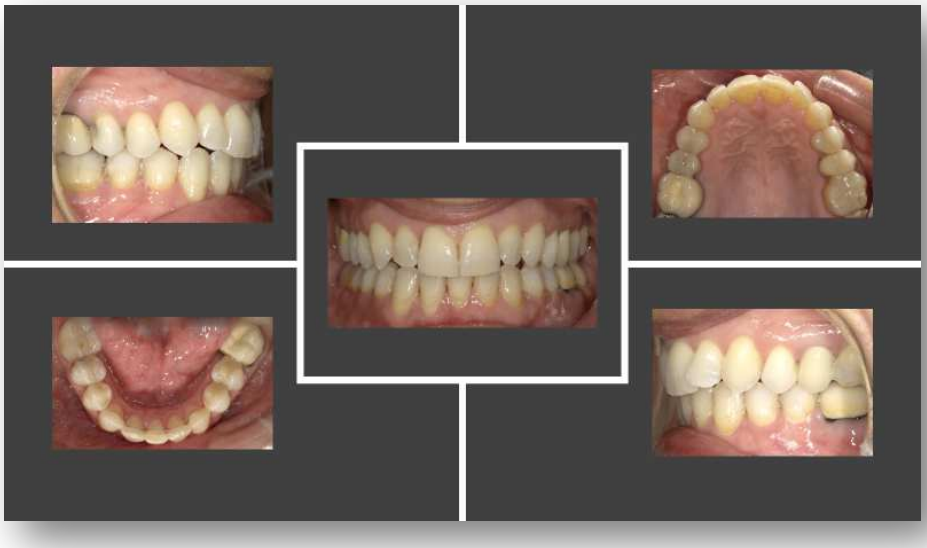
A 35 years old healthy female patient that presented for only mandibular arch treatment only. Triamond brackets were bonded and she was referred for extraction of her mandibular right central incisor (41). A 0.014" NiTi arch wire was placed following the extraction together with a long-span elastic chain from tooth 31-to-42. A 0.016" NiTi arch wire was placed at the third appointment together with a medium-span elastic chain from first molar-to-first molar. The Wedgewise wire was inserted at the forth appointment together with short-span elastic chain. Brackets were removed after 5 months of treatment. Please note the parallel tooth movement throughout space closure without any wire bending or bracket bonding compensations. Torque control was achieved, and root integrity was maintained.



Treatment duration 3 months

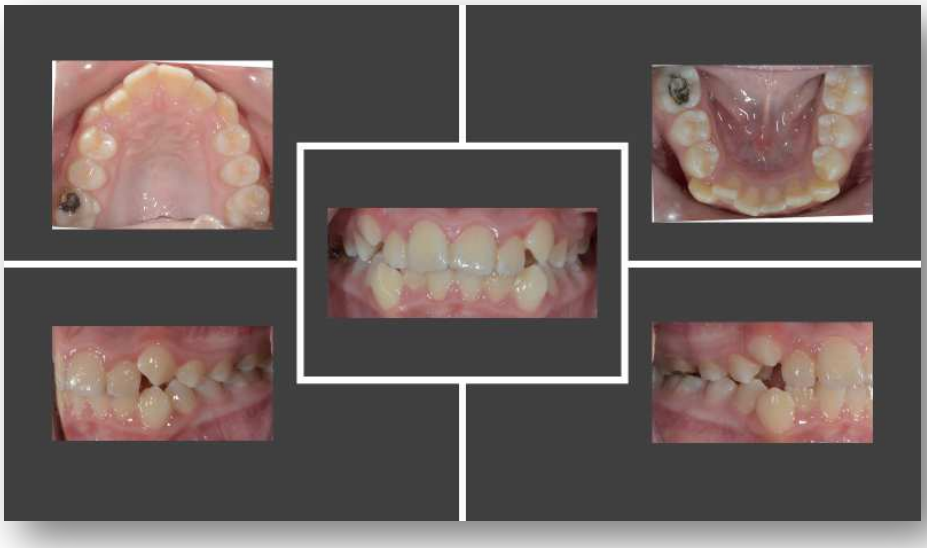
**** bonding June 11th, 2019 // debonding November 11th, 2019 ****





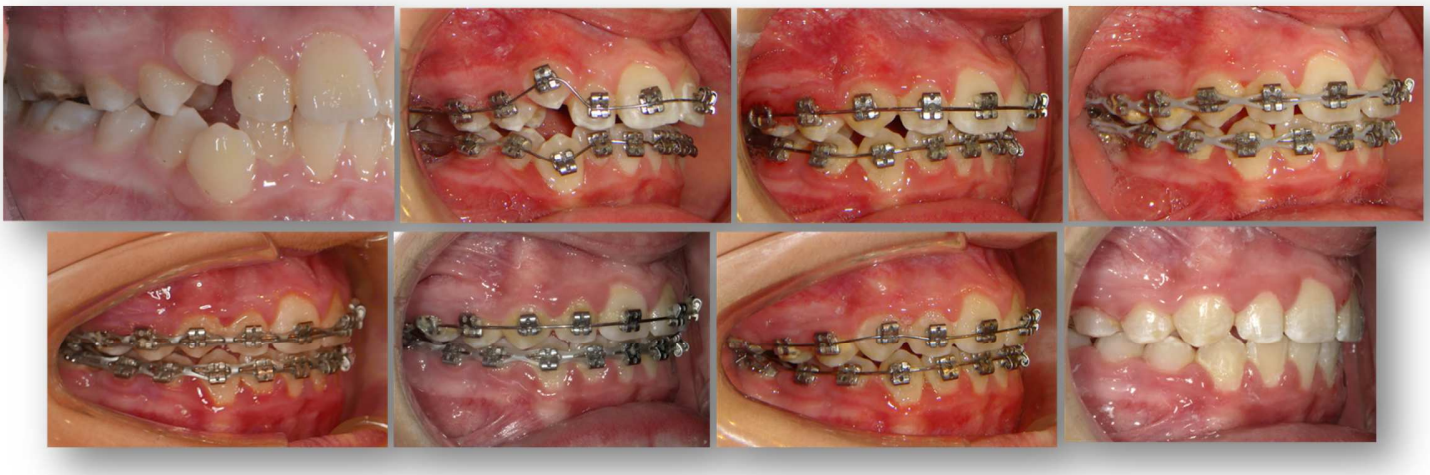
Case 2

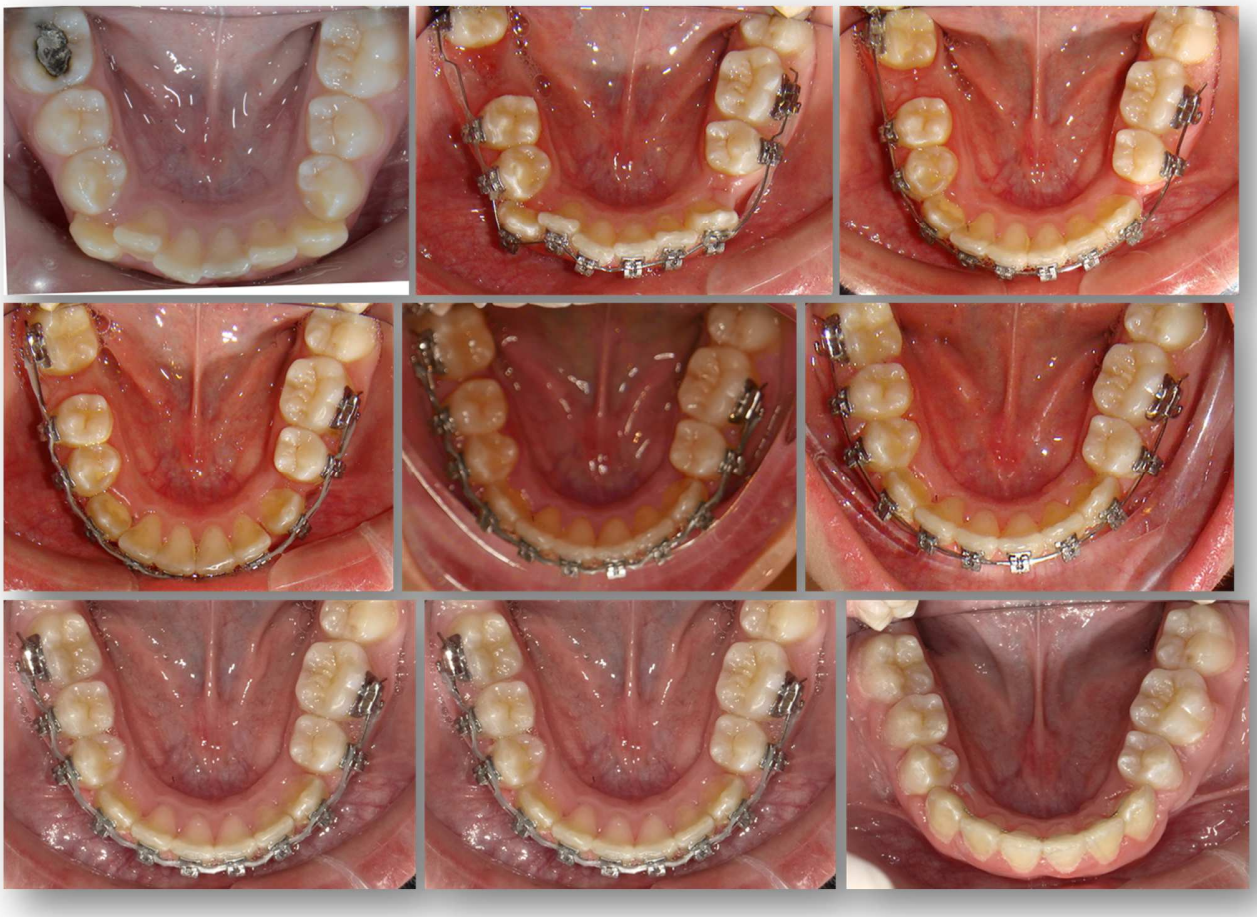
An 11 years old female patient with chronic asthma, a Class II div 1 malocclusion with moderate-to-severe dental crowding and slight incisor proclination, and development of all third molars. She also presented with recurrent caries and loss of the mesial buccal cusp of her maxillary right first permanent molar. She was referred for extractions of teeth 16,24,34 and 46. Triamond® brackets were bonded and treatment was initiated with 0.016" NiTi arch wires, with long-span elastic chains from 36-34 and 47-44. The Wedgewise wires were inserted at the third appointment with 4oz. class II elastics full time on her right and night time on her left. Elastic chains and asymmetric intermaxillary elastics were used for the next 3 appointments. After 13 months of treatment, the appliances were removed. Post treatment radiographs show the positive changes on incisor inclination and protraction of tooth 47, as well as the preservation of root integrity.

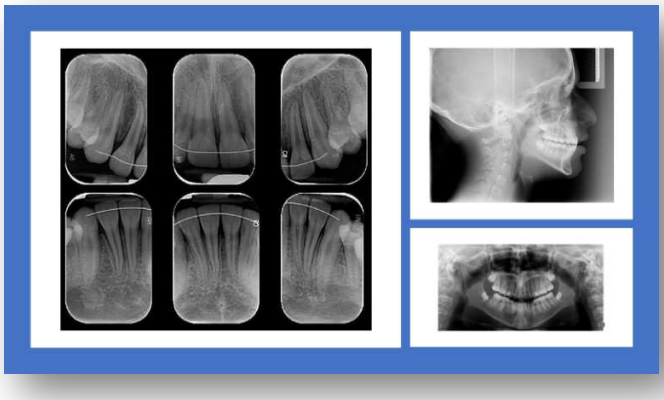


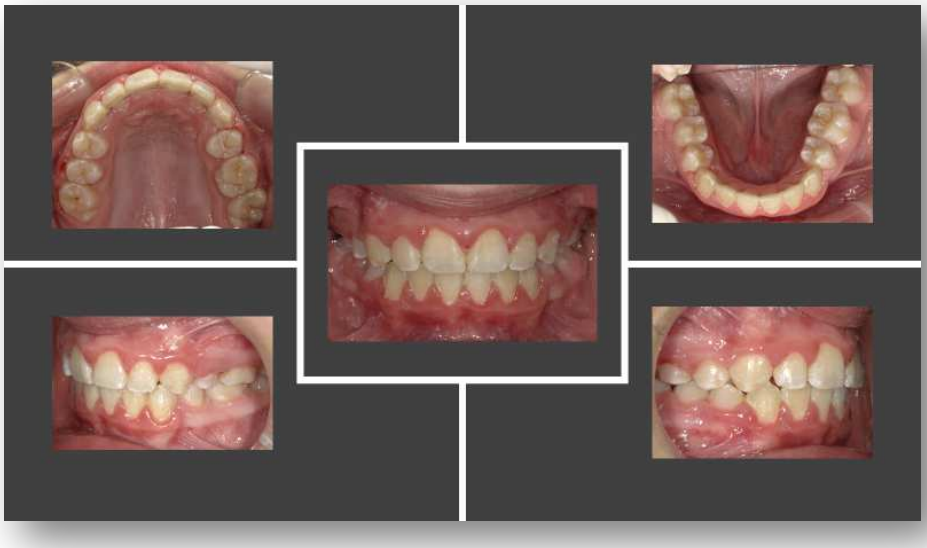
Treatment duration 13 months

**** bonding January 9th, 2019 // debonding February 24th, 2020 ****



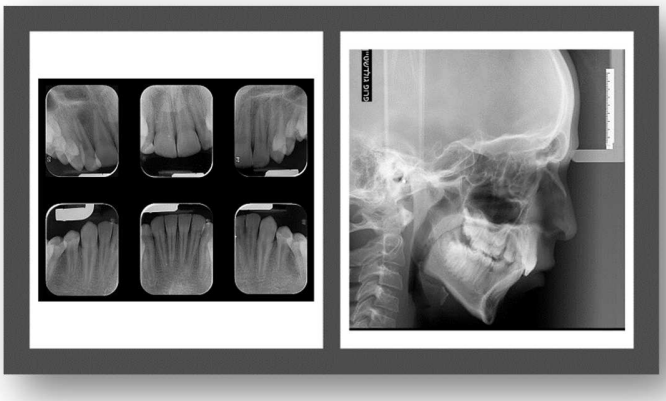






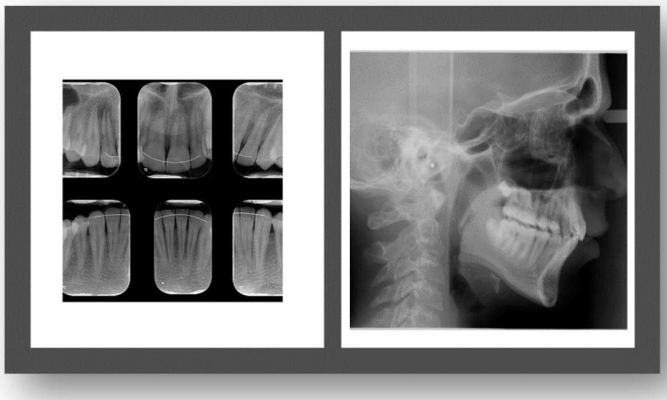
Case 3

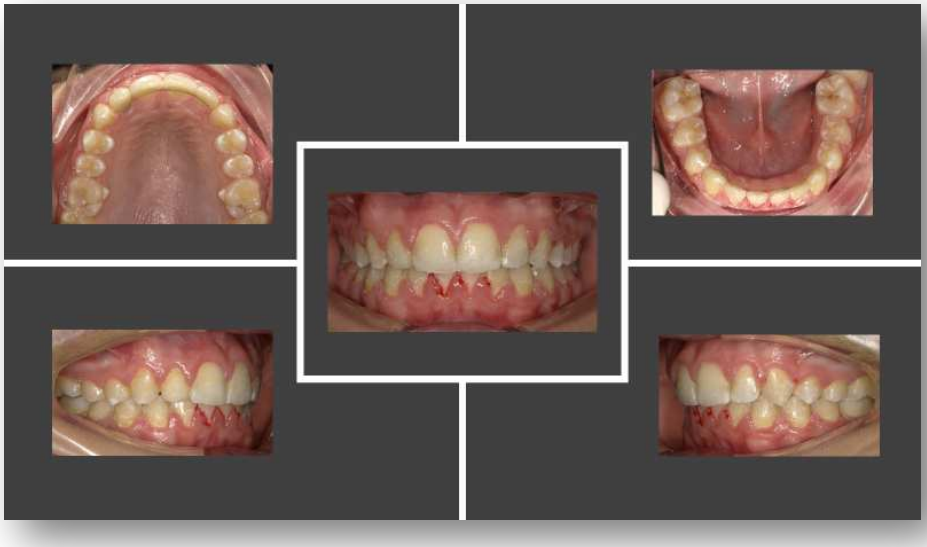
A 14.7 years old healthy male patient. Treatment was initiated with a Carriere® Motion™ Class II device, however, the patient was uncooperative and lost 4 mandibular omnivac retainers. This was discontinued and Triamond brackets were placed with 0.016" NiTi arch wires with ¼" 4oz. class II elastics. He achieved Class I molars and canines within 6 weeks, and the Wedgewise wires were inserted. He was debonded after nearly 4 months of treatment. Significant dental re-alignment can be seen clinically, and radiographic improvement of interincisal relationships as well as root integrity can also be seen.



Treatment duration 11 months

**** bonding June 18th, 2019 // debonding May 25th, 2020 ****





Bibliography

1. Peck S. A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 1. *Angle Orthod*. 2009;79:1021–1027.
2. Vaden JL. A century of the edgewise appliance. *APOS Trends Orthod*, 2015;5:239-49.
3. Angle EH. The latest and best in orthodontic mechanism. *Dent Cosmos*. 1928;70:1143-58.
4. Angle EH. The latest and best in orthodontic mechanism. *Dent Cosmos*. 1929;71:164-74.
5. Angle EH. The latest and best in orthodontic mechanism. *Dent Cosmos*. 1929;71:260-70.
6. Angle EH. The latest and best in orthodontic mechanism. *Dent Cosmos*. 1929;71:409-21.
7. Bernstein L. Edward H. Angle versus Calvin S. Case: extraction versus nonextraction. Part II. Historical revisionism. *Am J Orthod Dentofac Orthop*. 1992; 102: 546-51.
8. Peck S. A Biographical Portrait of Edward Hartley Angle, the First Specialist in Orthodontics, Part 2. Angle Orthod. 2009;79:1028–1033.
9. Consolaro A. Force distribution is more important than intensity!. *Dental Press J. Orthod*. vol.19 no.1 Maringá Jan./Feb. 2014
10. Tanne K, Koenig HA, Burestone CJ. Moment to force ratios and the center of rotation. *Am J Orthod Dentofac Orthop*. 1988;94(5):426-431.
11. Burstone C. Application of bioengineering to clinical orthodontics. In: Graber T, Vanarsdall R, eds. Orthodontics: current principles and techniques. St. Louis: Mosby, 2000.
12. Storey E, Smith R. Force in orthodontics and its relation to tooth movement. *Aust J Dent* 1952; 56: 11-8.
13. Smith R, Storey E. The importance of force in orthodontics: the design of cuspid retraction springs. *Aust J Dent* 1952; 56:291-304.
14. Boester CH, Johnston LE. A clinical investigation of the concepts of differential and optimal force in canine retraction. *Angle Orthod* 1974; 44: 113-9.
15. Vaden JL, Dale JG, Klontz HA. The Tweed-Merrifield edgewise appliance: philosophy, diagnosis, and treatment. In: Graber TM, Vanarsdall RL, eds. Orthodontics: current principles and techniques. S1. Louis: Mosby-Year Book, Inc., 1994:627-84.
16. Isaacson RJ, Linduer SJ, Davidovitch M. On Tooth Movement. *Angle Orthod*. 1993;63(4):305-9.
17. Kojimaa Y, Fukuib H. Numerical simulation of canine retraction by sliding mechanics. *Am J Orthod Dentofac Orthop*. 2005;127:542-51.