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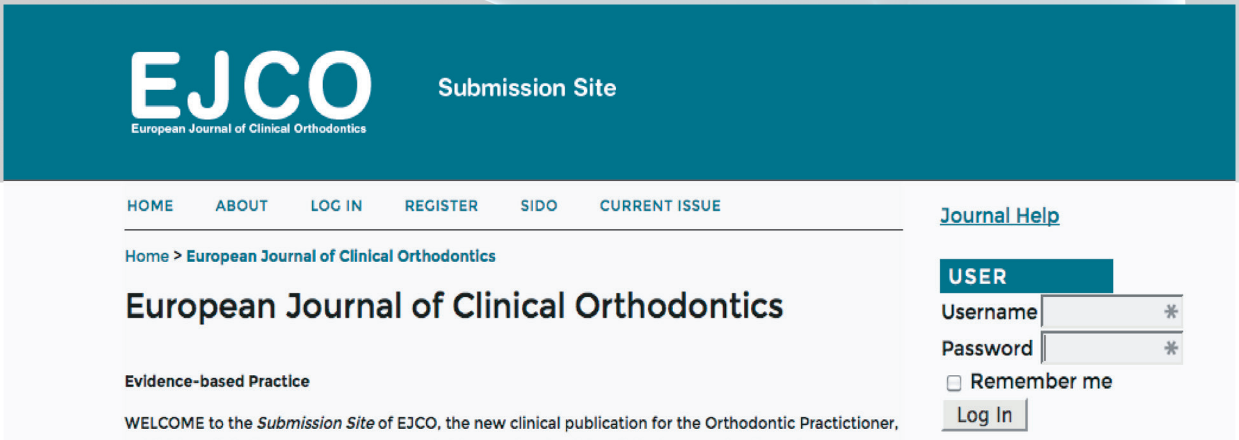

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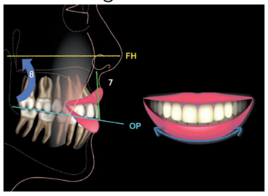

Figure 1: Normal Occlusal Plane
One of the factors contributing to the smile arc is cant of the occlusal plane. With an 8 degree cant, it is easier to attain smile arcs, and esthetics is less sensitive to bracket placement

Source: Begin with the End in Mind and Finish with Beauty, *Thomas Pitts*, p. 42.

EDITORIAL

Why a New Orthodontic Journal

Raffaele Schiavoni
Editor-in-Chief

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We asked ourselves this question before starting on the first issue of EJCO.
We had many doubts, as numerous prestigious journals are already being published today.
However, as "clinical orthodontists" we had a continuous feeling that a small piece could still be added to the mosaic of our extraordinary profession.
This feeling is now a certainty!
The cultural level of the orthodontists and therefore also the quality of orthodontic treatments have increased and so has the number of orthodontists in Europe and in the world. Many opinion leaders are present at our international meetings, where they promote new techniques and new treatment strategies. In addition to this, the unstoppable technological evolution continually provides new therapeutic tools that are the very basis of new prognostic scenarios, which could not even be imagined only a few years ago.
At the same time, new diagnostic tools evidence problems that can no longer be neglected by the orthodontists, for example the problems related to Temporomandibular joint dysfunction (TMD).
For all these reasons, we would like to produce a journal whose objective is to provide quality education rather than information.
Hopefully, we will succeed...

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WHO'S WHO

In this section we introduce an influential orthodontist who has given a significant contribution to the specialty. An article by the author featuring his landmarks follows.

Tom Pitts

Tom Pitts was born in the small copper mining town of McGill, Nevada, USA. At the age of 6, his family moved to Reno, Nevada, where his father found work as a cabinet-maker.

At 11 years of age, Tom had the good fortune to meet a paediatric dentist who inspired him to set goals and take studying seriously – to get excellent grades – in order to attain his new dream of becoming a dentist. He never wavered from this dream.

His senior year in dental school brought Arthur Dugoni back from orthodontic training to teach undergraduate orthodontics. With this great teacher/orthodontist as a new mentor, Tom created a new dream. He was going to be an orthodontist. So, after serving two years in the army, he was accepted into the University of Washington orthodontic programme, chaired by Richard Reidel.

He then started practising in Reno and attended numerous postgraduate courses, meeting and being trained by "forward thinkers" such as Bob Ricketts, Larry Andrews, Ron Roth, Karl Nishimura and others.

In the late 1970s, he began working with "A" Company to assist in their orthodontic product development, as well as lecturing on case management. He consulted with Ormco in this same capacity after their purchase of "A" Company.

In the late 1990s, Tom was asked by Robert Boyd and Dugoni to become an orthodontic clinical professor at the University of the Pacific, Arthur A. Dugoni School of Dentistry, where he continues teaching today as an associate clinical professor.

In the mid 1990s, his son Arnie graduated from the orthodontic programme at the University of Washington and joined his father in the practice. Tom turned the practice over to his son in 2009 and worked full-time for Ormco until November 2012 in product development, working in their clinic, testing products on patients, lecturing and helping with their teaching team.

In January, 2013, he was asked to join Scott Law from Texas in his orthodontic practice.

In December 2013, he also began working with OrthoClassic orthodontic company in product development, testing and research, and presently serves as Executive Clinical Director.

Tom created OrthoEvolve in 2012 with Duncan Brown from Canada. OrthoEvolve's purpose is to provide a teaching platform, in order to share with the orthodontic profession how he creates beautiful finishes.

Outside of orthodontics, Tom loves hunting, boating, fishing, golfing and travelling with his lovely bride Ouida.

Begin with the End in Mind and Finish with Beauty

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> *"I developed the SAP bracket placement technique to address the difficulty in attaining beautiful functional occlusal results, while enhancing the patient's esthetics. Learn this technique and your orthodontic results will improve dramatically, and your patients will love it!"*

Abstract

The aim of my journey in orthodontics has been to stretch the limits on aesthetic treatment goals. I have developed a treatment philosophy that takes orthodontic aesthetic results from good to great. My commitment is to maintain occlusal and functional harmony as well as excellent periodontal response while maximizing beautiful smiles and facial attractiveness. This article focuses on the upper incisors and how we have a tremendous responsibility to our patients to do everything under our power to enhance aesthetics. Keeping the upper incisor more forward than traditional orthodontics, protecting or enhancing the smile arc, incisal display, proper labial lingual inclination and proper tooth contouring by positive or negative coronoplasty are all very important to achieving my goals. Smile arc bracket positioning and case management are accomplished with this aesthetic end in mind, without sacrificing functional goals. I call this approach a smile arc protection (SAP) strategy.

Keywords
Bracket placement, SAP, esthetics, functional occlusion, case management

INTRODUCTION

I began my orthodontic training while in dental school by observing my first mentor, Arthur Dugoni, in his practice in South San Francisco. After 2 years of military service and 2 years of residency training, I received my MSD in orthodontics from the University of Washington in 1970. Graduating from my residency was just the start for me, and I was particularly hungry for knowledge that went beyond the training from the University of Washington.

Since then, I have been fortunate to have met and be trained by many of the "great" orthodontic practitioners and forward-thinking members of our profession: Bob Ricketts, Larry Andrews, Ron Roth, Karl Nishimura, David Sarver, and many, many others. As with most experienced practitioners, my professional approach is an amalgamation of critical concepts "shamelessly stolen" from others, tempered by hard-earned experience over more than 40 years of clinical practice.

I am particularly grateful to Ron Roth, who taught me discipline in approach to occlusal concerns, and to this day I treat to centric relation (CR). Karl Nishimura schooled me in muscle function and functional orthodontics. The first orthodontist whom I saw routinely expand archwires to gain space and form beautiful wide smiles was Bob Ricketts. Ricketts finished his cases with lip postures that were fuller than was fashionable in orthodontic circles at the time, but the approach of minimizing retraction of the upper anteriors to preserve lip support is now broadly adopted.

Many orthodontists are "defined" by the appliances that they use (whether it be traditional, active or passive self-ligation) or by the personal orthodontic guru whose treatment philosophy they follow (Roth, MBT, Alexander, Damon). Contrary to a widely held view, I don't really have a preference for a particular appliance, as long as the goal of the final result is occlusal and aesthetic excellence. At this time, I am partial to the high-quality OrthoClassic appliances, because of their tightened tolerances and more predictable results.

It has been said that "excellence is a journey not a destination", and my journey has been one of continual education through Continuing Education (CE) courses, study groups, visiting practices and mostly by teaching and sharing (which solidifies my ideas and concepts). When I began to take photographs at each appointment, it greatly raised my level of finishing. I would encourage every orthodontist interested in excellence to become efficient in taking intra-oral (IO) photographs of every patient at every visit. For me, it is the unbiased review of sequential photographs that has allowed me to develop my case management strategies and treatment protocols and understand the effect of treatment on aesthetics. In that context, I hope to provide orthodontists with a perspective of the "results-driven" treatment planning and simplified case management in my teaching.

CONTEMPORARY TREATMENT GOALS

As background, for many years, treatment directed towards the myth of occlusal stability has frequently been at the expense of important occlusal, aesthetic and functional factors. Today's "progressive" orthodontist understands the following aspects of orthodontic treatment, whether extraction or non-extraction:

1. arch length decreases after orthodontic treatment;
2. arch width as measured from the cuspids typically decreases irrespective of expansion or extraction;
3. post-treatment mandibular crowding occurs well into older age as a usual phenomena;
4. third molar presence has little effect on anterior relapse;
5. degree of post-retention relapse is highly variable and largely not predictable from pretreatment records[1].

Extensive research and clinical experience has brought about a "new understanding" that permanent retention is a requisite to ensure a beautiful smile for a lifetime.

Every orthodontist I know seeks to create beautiful function and superior aesthetic results, with healthy periodontal condition and optimal temporomandibular joint health.

I treat cases to CR whenever possible. There has been much discussion of how to best attain this goal, usually without general agreement. I have gravitated towards a Peter Dawson-style approach[2] as something that is reproducible, relatively simple to do and broadly applicable during the course of treatment. One important aspect of this technique is "bi-manual manipulation" of the mandible as a means of disclosing centric occlusion/centric relation (CO/CR) discrepancies, occlusal interferences and centric "slides" prior to or during treatment. Mandibular position is evaluated at each appointment, and adjustments to mechanics or possibly coronoplasty done to address interferences that develop in the course of treatment. With disarticulation buttons, it is easy to manipulate the mandible. In those cases where manipulation is difficult and CR cannot be reproducibly determined, a "leaf gauge" is used to manipulate or mount the mandible models whenever necessary. I have found diagnostic mountings to be most appropriately applied in selective adults or surgery cases where a maxillary procedure is indicated and cases where the nature of posterior interferences is uncertain.

I began looking closely at facial and smile aesthetics in the early 1970s and have learned that facial ageing and beauty have a lot to do with the position of the upper teeth and lips. It has been my observation that many orthodontists provide "lip service" to aesthetics and then immediately focus on "putting beautiful plaster on the table". With this process, post-orthodontic cases can experience aesthetic decline[3].

CONTEMPORARY AESTHETIC GOALS

Today's orthodontic consumer has a different aesthetic paradigm than was prevalent decades ago. Fuller profiles and lips, broader smiles, increased enamel display, some gingival display (especially in women), beautiful lip drape and vermillion curl are preferred. This has encouraged broader adoption of a non-extraction approach in "borderline" cases. However, too often, accomplishing non-extraction tooth alignment adversely affects the aesthetic outcome through poorly controlled axial inclination (proclined anteriors).

From my experience, I have identified the "top 10 aesthetic factors" that I impact orthodontically:

- Increased dental mass over skeletal volume: so the teeth are prominent in the smile, further forward in the face and positioned vertically in anticipation of ageing.
- Idealized inclination of the upper incisors and canines: Patients are more sensitive to adverse changes in axial inclination than to changes in A/P position[4].
- Idealized smile arc: idealized smile arcs are more attractive and youthful[5].
- Incisal and gingival display: Some gingival display and full enamel display are appropriate in a posed smile[6].
- Wide arch width, particularly in the molars: Smiles with small buccal corridors are more aesthetic, in both men and women[7].
- Arch shape that is wide in the molars, not too flat anteriorly and not too wide in the canine area: arches that are sufficiently broad to see the first molars are highly attractive.
- Rounded incisal edges and cusp tips.
- No "pepper" spots.
- Full lips: as the lip support reduces with ageing, fuller lips in adolescents is the best strategy[8].
- Adequate chin projection and profile balance.

Today's orthodontic patient demands a superior aesthetic outcome in addition to a significantly improved functional occlusion. The contemporary orthodontist needs to expand his/her mechanical capability beyond reliance on improved "straight-wire" appliance theory to attain superior aesthetic results.

Over 50 years ago, prosthodontists were talking about the "curved smile line" being a sign of youthfulness and attractiveness. Sarver and Ackerman renamed this curved smile line the "smile arc". I think this name is very appropriate and it is widely used today in orthodontics. The more I studied post-orthodontic cases, the more I could see how we as orthodontic practitioners were ending up with very little arc to the upper incisal edges in our finished smiles. This was disturbing to me. Often, my class II division 2 patients had a much better smile arc to their upper incisors prior to my treatment and I then proceeded to flatten this incisal plane with my treatment. This was not aesthetic to my eye and didn't contribute to a youthful looking smile, which is the "end I have in mind".

I have found that several factors can contribute to difficulty in attaining great smile arc, enamel display and occlusal results:

1. bracket position and the effect on the wire plane, where incisal bracketing reduces the creation of the smile arc through the wire plane;
2. the steepness of the upper occlusal plane, where flat occlusal planes are more difficult to manage;
3. incisor inclination, where proclination of the upper incisors flattens the smile arc;
4. shape of the cuspids, where long cusp tips preclude bracket positions that can positively affect smile arc; and
5. arch shapes that are very wide anteriorly, where broadness between the cuspids flattens the curve of the smile arc.

Smile arc is closely connected to enamel display. If the upper incisors do not show enough with the smile, then the arc becomes less noticeable, and if the smile is too "gummy", it detracts from the beauty of the arc as well.

CASE MANAGEMENT PRACTICES

My clinical focus has involved development of improved simplified "case management" practices, combined with a sound understanding of the impact of varying bracket position, bracket torque and use of modern shaped archwires to assist the orthodontist.

SAP BRACKET POSITIONING

Many years ago, I began experimenting with bracket position and wire plane to obtain a more curved smile arc.

To me, SAP bracket placement[9] is a "case management" strategy that improves my aesthetic and occlusal end result. So, as I say, "begin with the end in mind", plan treatment based on aesthetic goals and execute case management strategies to address aesthetic needs.

Many years ago I found that placing anterior brackets more gingival improved enamel and gingival display.

I adjust the vertical position of the

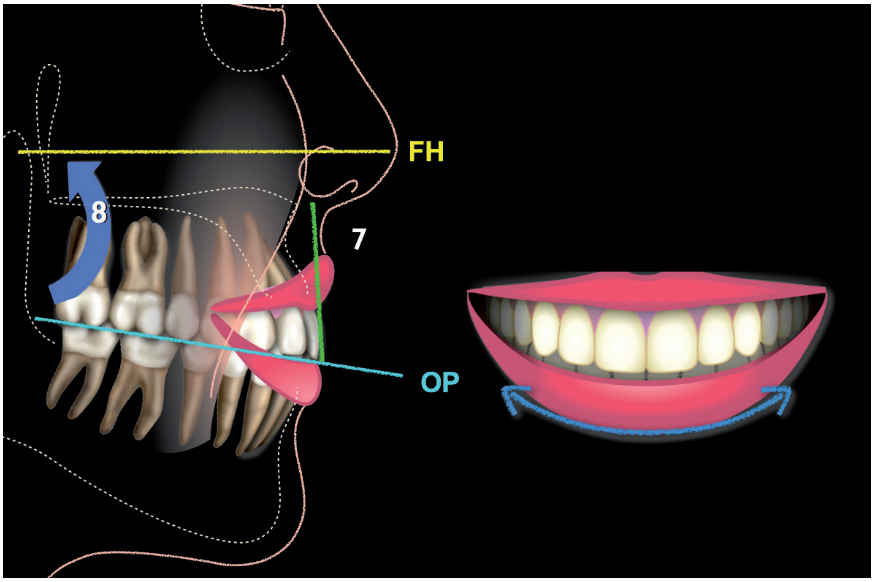

Figure 1: Normal Occlusal Plane
One of the factors contributing to the smile arc is cant of the occlusal plane. With an 8 degree cant, it is easier to attain smile arcs, and esthetics is less sensitive to bracket placement.

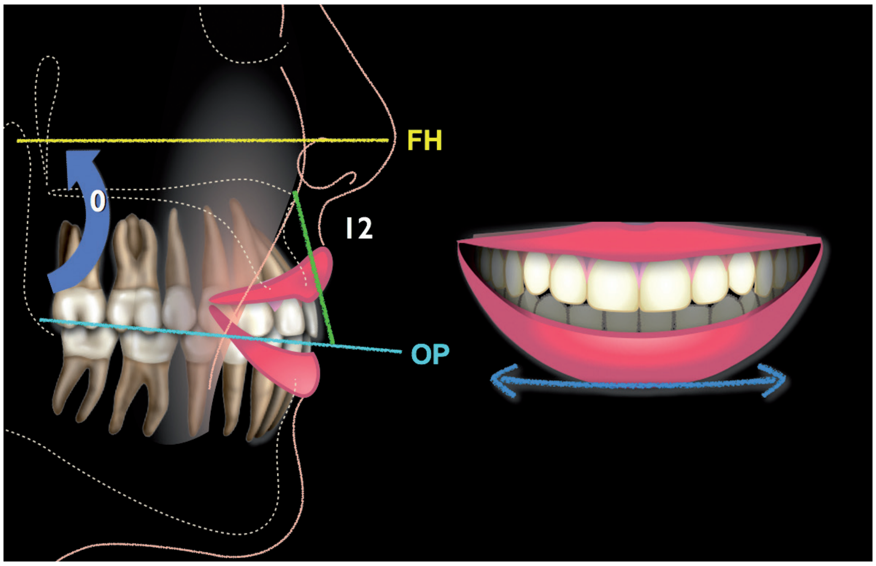

Figure 2: Flat Occlusal Plane
Upper incisors too proclined with flat occlusal planes smile arc is more difficult to attain.

upper incisors and cuspid relative to the upper posteriors. I place lower posterior brackets more gingival to avoid the occlusion and the lower anterior bracket more incisally to intrude the lower anteriors and optimize overbite.

My approach to bracket placement has been refined and has come to be called a smile arc protection (SAP) approach*. This technique has been described a few times[9, 10], and rather than repeat those details, I'd like to explain the basics of the SAP technique and how it eases the difficulties outlined above.

- SAP bracket position is designed to gain optimal aesthetics and sound occlusions[9]. As a smile arc develops from maxillary first molar to maxillary first molar, it is important to assess the occlusal plane of the maxillary arch with the head in natural position. Where straight-wire theory suggests the bracket slot should be positioned at FA (centre of anatomic crown), SAP[9] and my case management principles follow a different approach. In patients with "flat" occlusal planes, the progression of the wire plane created by bracket position must increase to develop the smile arc by extrusion of the maxillary incisors relative to the maxillary bicuspids. In patients with normal occlusal planes, a more modest progression in the wire plane is still advisable to protect the smile arc as the upper arch broadens with treatment (*Figs. 1 and 2*). In cases with steep occlusal planes, and excessive enamel display, a modest progression is still advised. It is important to remember that large bracket progressions in the upper arch must be compensated for by increased "overlevelling" of the lower arch to maintain optimal overbite through bracket position. Assessment of the upper occlusal plane in a natural head position is important as a smile arc develops from upper first molar to upper first molar (*Figs. 3 and 4*).
- One common aesthetic mistake I see is that orthodontists tend to focus on intrusion of the upper anterior teeth in deep bite cases. Upper incisor intrusion frequently occurs at the

* Term courtesy of Duncan Brown

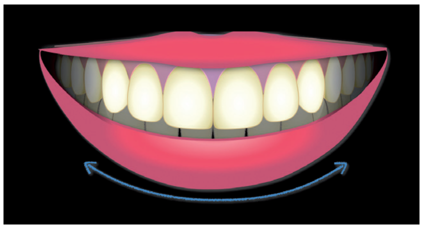

Figure 3: Smile arc
Beautiful smile arc...where would the brackets have to be placed to create this?
There is no "single" ideal bracket position. Bracket position depends on the esthetic and functional needs of the individual patient .

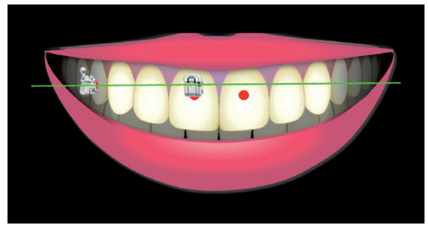

Figure 4: SAP Bracket position
Upper incisor brackets are positioned apical to FA to protect the smile arc.
Note: This plane can be more gingival to FA on the anteriors to enhance or protect the smile arc.

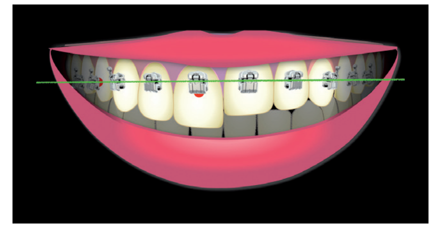

Figure 5: SAP versus Traditional Bracket Placement
SAP Approach with vertical height of bracket determined by aesthetic need with Smile arc protected or enhanced.
Bracket slot at FA with vertical height of bracket set at FA with Smile Arc flattened with slot positions at FA or incisal to FA, smile arc can be flattened.

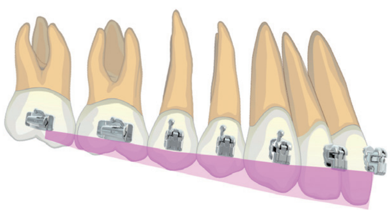

Figure 6: Bracket Divergence
Brackets slots heights progress more apically from posterior to anterior.

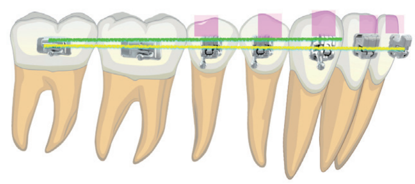

Figure 7: Lower Arch Compensation
In the lower arch, anteriors are "overleveled" to allow development of the smile arc without deepening the bite.

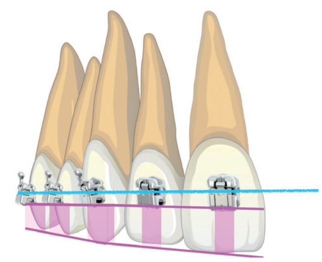

Figure 8: Upper Buccal Segment and Cuspid
The cuspid sets the Smile Arc, divergence continues through the anteriors, and the position of the anteriors is critical.

expense of dental aesthetics and frequently results in a reduction in smile arc and decreased enamel and gingival display. In some cases, proclination of the upper incisor carries the dual risk of intrusion flattening the smile arc and inducing excessive proclination, which adversely affects smile aesthetics[7].

- Individualized bracket placement is required to optimize aesthetics. Most orthodontists understand that in the "straight-wire theory", placement of the bracket slot at FA (centre of the crown) is required to gain optimal torque expression relative to the occlusal plane, using archwires that "fill up the slot"[11]. This misconception pervades the speciality even today. My reality is that I do not fill the slot, so that the prescription "built into" the bracket is seldom fully expressed. In SAP[10], placement is determined to optimize aesthetic requirements rather than rely on technology built into the bracket to optimize axial inclination (*Fig. 5*). Case management is the key to control of axial inclination. However, I like the built in torque of the upper anteriors in the OrthoClassic H4 bracket (Roth Rx), which requires less torsional adjustment with wires than other, higher-torqued prescriptions.
- SAP bracket placement aligns the contact points[9] (*Figs. 6–8*). As the contact point heights progress apically from posterior to anterior in the upper arch, the slot plane follows the same progression. As cusp height to contact point height varies, it is inevitable that occlusal adjustments are required to optimize the centric stops throughout the occlusion, while having the contact points aligned. I adjust occlusion throughout the finishing stages of treatment.
- Pre-bonding "positive and negative" coronoplasty is very important. It is harder for me to attain great aesthetics with teeth that are not "optimized" for shape and contour. When done prior to bonding, aesthetic re-contouring improves my ability to place brackets in a more ideal location to maximize the smile arc, optimize axial inclination and control first- and second-order changes in tipping mechanics. Prior to bonding, I

concentrate on softening the cusp tips of the canines and first bicuspids, normalizing facial irregularities and optimizing length/width ratios of the maxillary anterior teeth. I re-contour 95% on upper canines prior to bracketing. Lengthening of the contact points/lines, adjusting embrasure spaces and slenderizing for tooth size discrepancies are generally accomplished after the anteriors are aligned. Adjustments to optimize centric stops are made during the finishing stages of treatment. All the surfaces that have been adjusted are polished with a white stone and black rubber tip in a high-speed hand piece prior to bonding.

- SAP bracket positions are more effective for me in management of axial inclination[9]. This is true in both the tipping and the torsional phases of treatment mechanics. Early in treatment, incisor extrusion creates a retroclining moment that helps control proclination as crowding unravels, when supported by early light short elastics (ELSE) and proper disarticulation buttons. In the torquing phase of treatment, SAP makes the effective bracket Rx slightly more negative, which helps recover from non-extraction proclination later in treatment.
- SAP[9] bracket position is most effective when applied in conjunction with other key case management principles: ELSE, disarticulation and arch wire (AW) progression strategies all leverage SAP bracket positions to the fullest advantage[9] (*Figs 9–18*).

In this article, we have talked about two case management strategies that improve my aesthetic and occlusal end results: pre-bonding coronoplasty and SAP bracket position[9]. From my point of view, it is important to "begin with the end in mind" plan treatment based on aesthetic goals, execute case management with excellence, evaluate progress and adjust mechanics as needed. Modern orthodontists live at the intersection of art and technology. By applying the best of technology to an artistic end result, we can do the best for our patients, and SAP bracket position is a wonderful tool in that journey.

Until next time...

Figure 9: Sample Patient Initial Records
Initial Records: (a) Frontal Rest, (b) Frontal Smile, (c) Profile Rest.

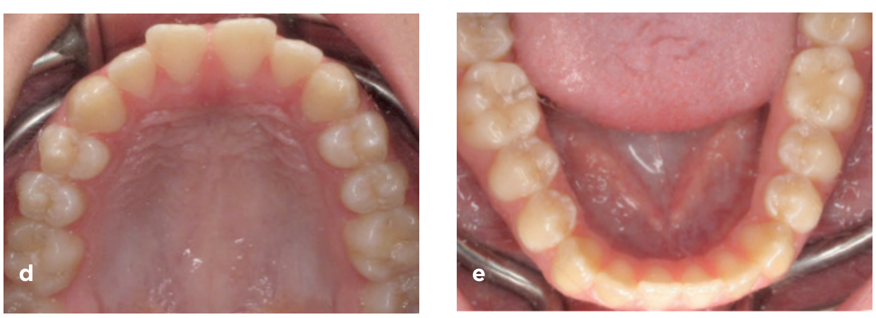

Figure 10: Sample Patient Initial Records
Initial Records: (a) Right Buccal, (b)Center, (c) Left Buccal, (d) Upper Occlusal, (e) Lower Occlusal.

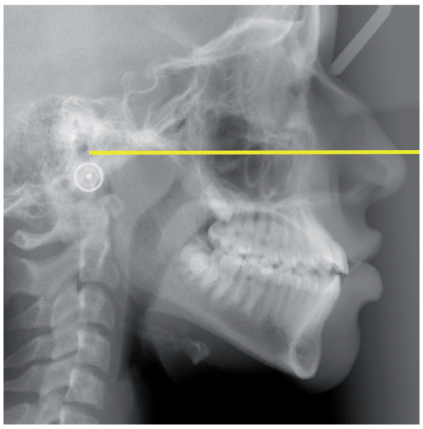

Figure 11: Cephalometric X-ray
Upper incisors are proclined and occlusal plane is flat.

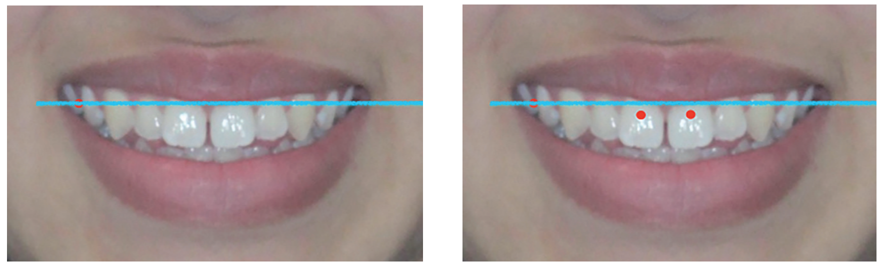

Figure 12: Enhancing the Smile Arc
Brackets must be placed apical to FA to enhance or protect the Smile Arc.

Figure 13: SAP Bracket Placement
Brackets must be placed apical to FA to preserve or develop the Smile Arc.

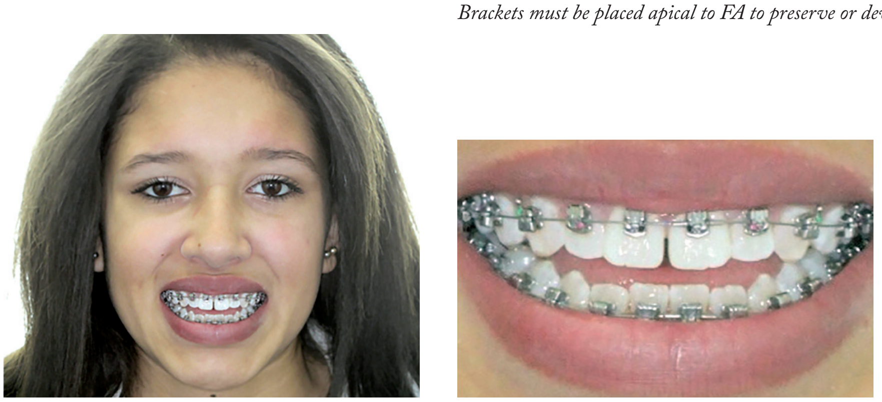

Figure 14: Enhancing the Smile
Case Management Principles: SAP Bracket Placement, Disarticulation, and ELSE.

Figure 15: Smile Arc Development
Great protection in the Smile Arc as a result of SAP Bracket Placement, Disarticulation, and ELSE.

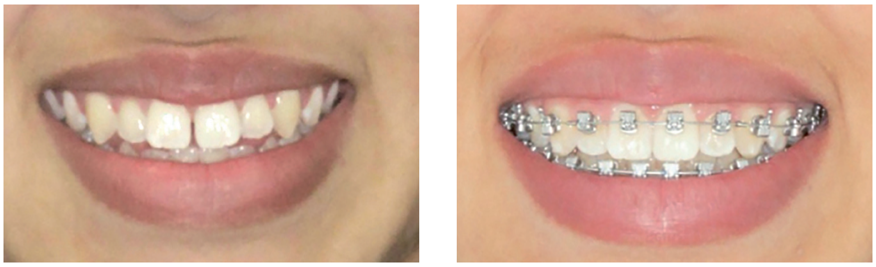

Figure 16: Smile Arc Development
Great improvement in the Smile Arc as a result of SAP Bracket Placement, Disarticulation, and ELSE.

Figure 17: Axial Inclination Improvement
Great improvement in Axial Inclination as a result of SAP Bracket Placement, Disarticulation and ELSE.

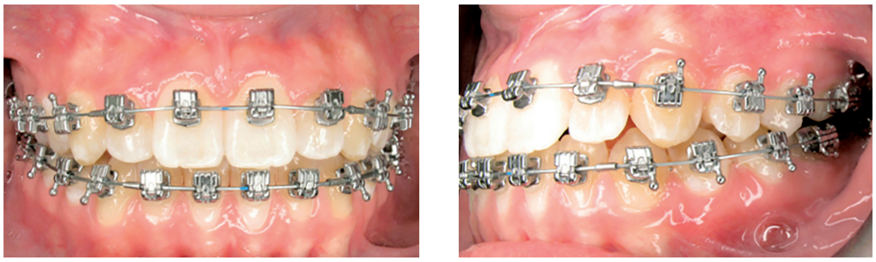

Figure 18 Occlusal Improvement
Great improvement in Occlusion as a result of SAP Bracket Placement, Disarticulation and ELSE.

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En masse Retraction of Anterior Teeth with the Dynforce Archwire


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“The Dynforce archwire has been developed with the aim to improve the control of incisor torque and to reduce friction on posterior teeth.”

Abstract

The present article explains the clinical application of the Dynforce archwire for en masse retraction of front teeth. The Dynforce archwire is a bidimensional wire with edgewise rectangular cross sections. Two clinical cases are presented. In the first case, the Dynforce archwire is used with temporary anchorage device (TAD) miniscrews and maximum anchorage. In the second case, the archwire is used without miniscrews, with medium-reciprocal anchorage. The Dynforce archwire has a full-sized anterior segment (e.g. 0.021”x0.025”) and undersized posterior segments with rectangular cross sections (e.g. 0.018”x0.025”, 0.018”x0.022” or 0.017”x0.025”). The function of the anterior segment is to reduce wire-bracket play on incisors. This segment also presents higher rigidity, in order to maximise the expression of the information (tip and torque) of the preadjusted brackets on the incisor region. Posterior segments are undersized and hence have a lower rigidity. Lower rigidity minimizes binding of the archwire to the brackets of posterior teeth (canines, premolars, molars)[1,2]. The material of the archwire is heat-treated stainless steel. The archwire is utilised to retract the incisors or to close extraction spaces. Hooks 6.5 mm long are used when en masse retraction is performed with TAD miniscrews. Short hooks (i.e. 2–3 mm long) are utilized when retraction is performed with medium-reciprocal anchorage. The application of the archwire and its use with maximum, reciprocal or asymmetrical anchorage are presented, along with the biomechanics involved.

Keywords:
Incisor torque, friction, bidimensional archwire

INTRODUCTION

In closing extraction spaces using sliding mechanics with preadjusted appliances, problems such as deepening anterior bite, opening posterior bite and lingually tilted upper incisors can be found, especially in retracting anterior teeth with TADs. To overcome these problems, the Dynforce archwire has been developed.

The first bidimensional system in orthodontics was described by Shudy and Shudy in 1975[3]. The Authors utilized brackets with a 0.016" slot on the anterior teeth and brackets with a 0.022" slot on the posterior teeth. The 0.016"x0.022" archwire could give optimum torquing qualities for the anterior teeth, while the 0.006" play between the brackets and the wire in the posterior regions allowed rapid levelling in the early phases of treatment. Torque control on posterior teeth was achieved by making a 90° twist bend on the 0.016"x0.022" archwire distally to the canines, with the scope to fill the slot in the vertical dimension.

In 1985, Gianelly et al.[4] described a technique that maximises incisor torque control, allowing the sliding of the archwire along the brackets of the posterior teeth at the same time. Brackets with a 0.022" slot on all teeth were utilized. For the phase of incisor retraction, a ribbon archwire with size 0.022"x0.016" was used. The archwire was bent at 90° immediately distal to the lateral incisors by the orthodontist. Thus, the archwire consisted of an anterior zone with size 0.022"x0.016", which fitted the incisor brackets, and a posterior zone with size 0.016"x0.022", which fitted the brackets of canines, premolars and molars.

Subsequently, Gianelly modified the technique, utilizing brackets with a 0.018" slot on incisors and brackets with a 0.022" slot on canines, premolars and molars. In the bidimensional slot technique, space closure is traditionally performed in two steps. Canines are distalised on a 0.016"x0.022" stainless steel archwire. Then incisors are retracted on a 0.018"x0.022" archwire[5]. In a recent study, Giancotti et al.[6] utilized a conventional 0.018"x0.022" stainless steel archwire with crimpable hooks attached distally to the canines for en masse retraction of six anterior teeth with bidimensional slot self-ligating brackets.

We prefer to utilize brackets with 0.022" slots on all teeth. This allows the use of conventional full-sized (e.g. 0.021"x0.025") archwires to control torque of all teeth, especially during the final stages of treatment (finishing and detailing). The Dynforce archwire is used for the working phase of treatment, especially when sliding mechanics are required. Space closure is generally performed en masse, with simultaneous movement of canines and incisors.

The design of the Dynforce archwire is characterized by the presence of edgewise rectangualr cross sections in the anterior and posterior segments *(Fig. 1)*, and allows a choice between different sizes of cross sections in the various segments of the archwire, depending on clinical needs. Archwire cross-section size, and hence wire-bracket play and wire rigidity, can be changed in the various segments. For example, during space closure with reciprocal anchorage, posterior segments with size 0.018"x0.025" are preferred by the Authors, in order to minimize the bowing of the archwire. On the other hand, when front teeth are retracted en masse with direct anchorage from the miniscrews and with power arms 6.5 mm long, the deflection of the archwire is minimal. Hence, a thinner wire with dimensions such as 0.018"x0.022" or 0.017"x0.025" is utilized in the posterior segments to minimize resistance to sliding. The size of the anterior segment (0.021"x0.025" or 0.019"x0.025") can be chosen depending on the amount of incisor torque required

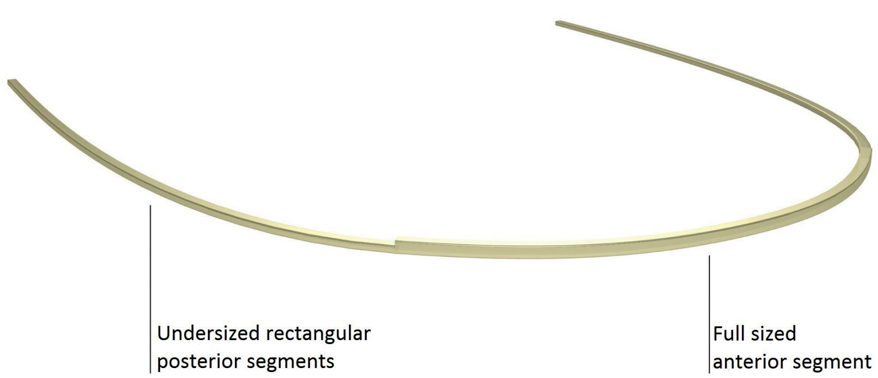

Figure 1: Design of the Dynforce archwire.
The Dynforce archwire is a bidimensional wire with edgewise rectangular cross sections. The full-sized anterior segment occupies the incisor brackets. The undersized posterior segments occupy the brackets of canines, premolars and molars.

in a particular clinical case, or depending on the value of torque present in the bracket prescription.

METHODS, RESULTS AND DISCUSSION

The Dynforce archwire *(Fig. 1)* has an anterior segment with the size 0.021"x0.025" and posterior segments with the size 0.018"x0.025". It is used in cases that require medium-reciprocal anchorage.

The low-friction Dynforce archwire has an anterior segment with the size 0.021"x0.025" and posterior segments with the size 0.018"x0.022" or 0.017"x0.025". It is utilized when anterior teeth are retracted *en masse* with direct anchorage from the miniscrews. In this case, hooks 6.5 mm long are positioned on the archwire between the lateral incisor and the canine.

The material of the archwire is heat-treated stainless steel (gold tone).

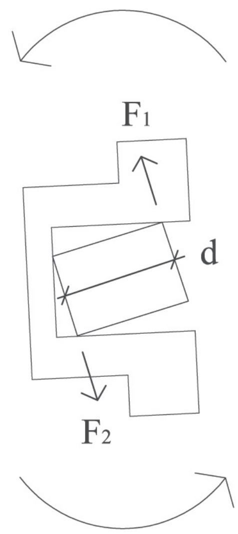

Figure 2: Sagittal section view of archwire and incisor bracket. The torsion of the archwire inside the bracket slot generates a moment of a couple, which equals F1×F2×d

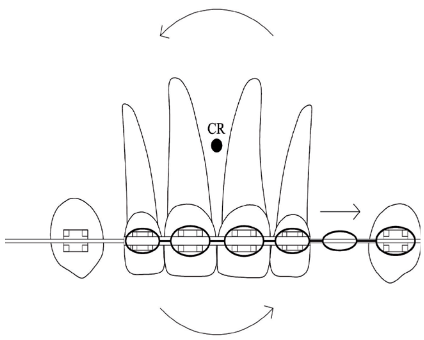

Figure 3: Canting of incisal plane with the use of asymmetrical Class I forces. When unilateral Class I forces are used, for example during midline shift correction, there is a tendency for the incisal plane to cant, since forces act below the CR of incisors. Higher rigidity of the anterior segment of the Dynforce archwire minimizes the deflection of the archwire and helps to reduce the problem.

Rationale of the Dynforce archwire

Today, most straight-wire techniques use sliding mechanics for retraction of anterior teeth or for extraction space closure. The wire generally used for this phase of treatment is a 0.019"x0.025" stainless steel archwire with short (i.e. 2–3 mm) posted hooks in brackets with 0.022" slots.

According to trigonometric rules, the theoretical play between the 0.019" x0.025" stainless steel archwire and the 0.022" slot is 7.3°[7]. However, due to manufacturing tolerances, bracket slots tend to be oversized while archwire cross sections can be undersized[8-10]. The vertical dimension (0.022") of the slot has been reported to be as large as 0.0237"[8].

As a consequence of manufacturing tolerances, the real play between the archwire and the bracket slot is consistently larger than the theoretical play. In a recent study, Brauchli et al. found that the amount of angulation needed between a 0.019"x0.025" stainless steel archwire and the 0.022" bracket slot to express a torquing moment of 10 N·mm, recommended for clinical effective torque expression, is 20°–25°[9].

For this reason, incisor torque control can be an issue during the retraction of front teeth, especially in the presence of long roots, dense bone or deep incisor overbite or in brachyfacial patients where greater buccal crown angulation is normally required.

In the Dynforce archwire, the most common size for the anterior segment is 0.021"x0.025", to further reduce the play between the archwire and the bracket slot, in order to ensure better incisor torque control. Higher rigidity of the anterior segment of the archwire also contributes to higher incisor torque expression. Torque is generated when the archwire is twisted in the third order of space and, due to the elastic properties of the material, it tends to return to its original non-twisted status, generating a moment of a couple inside the bracket slot[11]. The moment of a couple equals F1xF2xd, as shown in *Figure 2*. Archwires with higher torsional rigidity generate higher torquing moments.

Higher flexural rigidity of the anterior segment of the Dynforce archwire is also beneficial during the use of unilateral Class I forces, for example, during midline shift correction, since higher rigidity helps to prevent the canting of the incisal plane, as shown in *Figure 3*.

Posterior segments of the Dynforce archwire (0.018"x0.025", 0.018"x0.022" or 0.017"x0.025") have a rectangular cross section and not round, because the rectangular cross section offers better control of the arch form during space closure. Also, the rectangular cross section allows the wire to fill the horizontal dimension of the bracket slot by a larger extent, for better control of dental rotations. An undersized cross section reduces the rigidity of the archwire, thus reducing the coefficient of binding of the wire[1,2,12]. An undersized cross section also increases the critical contact angle, which minimizes binding phenomena during clinical use.

Biomechanics of the Dynforce archwire

A common problem encountered with en masse retraction with miniscrews and conventional archwires with short (i.e. 2–3 mm) posted hooks is the clockwise rotation of the occlusal plane, as shown in *Figure 4*. The retracting force, in fact, passes below the centre of resistance (CR) of the dental arch and produces a rotation of the six front teeth towards the palate and intrusion of the posterior teeth[13]. As a consequence, anterior deep overbite, loss of incisor torque and posterior open bite are created. As shown in *Figure 5*, the Dynforce archwire can be used in association with hooks 6.5 mm long. Miniscrews are placed between first molars and second premolars approximately 7–8 mm above the archwire. The anterior segment (0.021"x0.025") of the Dynforce archwire ensures good control of the incisor torque. Undersized posterior segments with rectangular cross sections (0.018"x0.022" or 0.017"x0.025") facilitate sliding. The retracting force passes close to the CR of the dental arch, and prevents the clockwise rotation of the occlusal plane, and all its undesirable side effects[14]. Prevention of the rotation of the six anterior teeth, further, reduces the angulation between posterior segments of the Dynforce archwire and the brackets of the posterior teeth (premolar and molar) during en-masse retraction, thus minimizing binding. The result is a faster retraction of the anterior teeth, without deepening of the anterior bite. It should be remembered that the resistance to sliding due to binding equals the coefficient of binding times the wire-bracket angulation beyond critical contact angle[2,15]. The use of a full-sized anterior segment (0.021"x0.025") in the Dynforce archwire allows reduction of the wire-bracket play in the incisor region. The minimum wire-bracket play on incisors and the use of power arms 6.5 mm long positioned

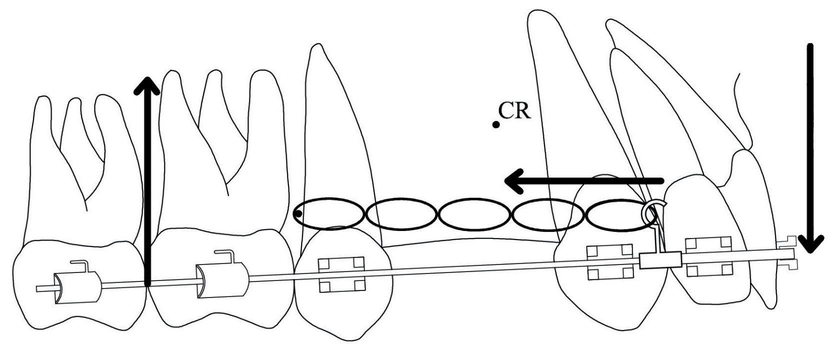

Figure 4 : Low-pull mechanics.
Clockwise rotation of occlusal plane when retracting anterior teeth with TADs miniscrews and archwires with short (i.e. 2–3 mm long) posted hooks. Retracting force passes below the CR of the dental arch. Intrusion of posterior teeth (posterior open bite) and extrusion of anterior teeth (anterior deep bite and loss of incisor torque) are the consequences.

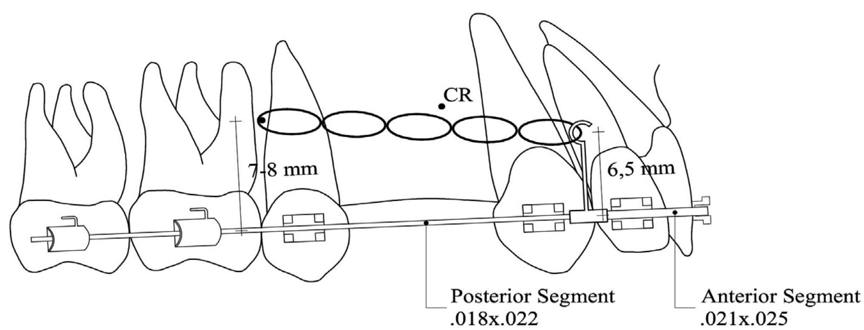

Figure 5 : Medium-pull mechanics.
En masse retraction with Dynforce archwire, miniscrews placed 7 mm above the archwire and power arms 6.5 mm long. Occlusal plane and incisor overbite are maintained during the retraction phase.

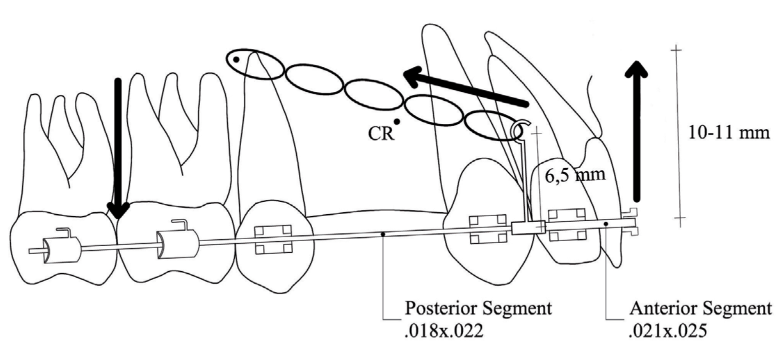

Fig. 6 : High-pull mechanics. Miniscrews are placed 10–11 mm above the archwire. The counterclockwise rotation of the occlusal plane produces a bite-opening effect during en masse retraction.

between lateral incisors and canines for retraction of front teeth with miniscrews are in agreement with finite element method (FEM) studies. The retracting force should pass close to the CR of incisors if incisors need to be retracted bodily (without tipping). The CR of incisors has been determined to be 7 mm above the archwire (bracket slot level)[16]. An FEM study showed that hooks 5.5 mm long and positioned between the lateral incisor and canine are long enough to achieve a translation (bodily movement) of the anterior teeth without tipping, and with minimum deflection of the archwire, when retraction is performed with sliding mechanics and miniscrews[14]. In order to achieve the same type of translatory movement of incisors, hooks need to be 11 mm long if they are positioned distally to the canine[14]. In a later FEM study[17], the same Authors investigated the effect of play between bracket and archwire on the retraction of front teeth with direct anchorage from miniscrews. Power arms were positioned between the lateral incisors and canines. They found that if there is no play between the wire and bracket (0.018”x0.025” archwire in 0.018” slot), bodily movement of maxillary incisors is obtained at 5 mm length of power arm. In case a play exists (0.016”x0.022” archwire in 0.018” slot), bodily movement is observed at the power arm length of 11 mm. In other words, the excessive wire-bracket play on the incisor region must be compensated for by a larger moment, generated by a longer power arm, to obtain a bodily movement of incisors. A power arm bringing the retracting force close to the CR of incisors is not sufficient to generate bodily movement of front teeth; it is also necessary that no play is present between the wire and bracket on the incisors.

Hence, the hooks most commonly utilized by the Authors are 6.5 mm long and are positioned between the lateral incisor and canine. The Dynforce archwire with full-sized anterior segment (0.021”x0.025”) is used when direct anchorage from miniscrews is utilized, in order to reduce wire-bracket play to as close as possible to 0° on the incisor region. We also highlight the importance of low resistance to sliding in the posterior segments of the Dynforce archwire during this type of mechanics. In fact, binding of the archwire to the brackets of premolars and molars would generate distal tipping of the molar crowns and, as a consequence, clockwise rotation of the archwire and of the maxillary occlusal plane. The use of undersized posterior segments (0.018”x0.022” or 0.017”x0.025”) with lower coefficients of binding and larger critical contact angles helps to minimize this phenomenon.

The position of miniscrews significantly affects the biomechanics of *en masse* retraction and the rotation of the maxillary occlusal plane. In a similar way to headgear biomechanics, a low-pull/medium-pull/high-pull mechanics has been proposed for miniscrew placement[18].

In low-pull mechanics, miniscrews are placed 3–4 mm above the archwire and short (2–3 mm) hooks on the archwire are used *(Fig 4)*. This system is used when the patient has an anterior open bite. The retracting force passes below the CR of the dental arch[19,20], as shown in *Figure 4*. This system produces a clockwise rotation of the occlusal plane, with deepening of anterior bite during the retraction of the anterior teeth.

In medium-pull mechanics, miniscrews are placed 7–8 mm above the archwire and hooks 6.5 mm long on the archwire are used *(Fig. 5)*. This system is used when the patient has a normal overbite. The retracting force passes close to the CR of the dental arch, as shown in *Figure 5*. This system maintains the occlusal plane during the retraction of the anterior teeth; incisor overbite is not changed during the retraction phase.

This system is the one most commonly used by the Authors.

In high-pull mechanics, miniscrews are placed 10–11 mm above the archwire and hooks 6.5 mm long on the archwire are used *(Fig. 6)*. This system is indicated when the patient has an anterior deep bite. The retracting force passes above the CR of the dental arch[19,20]. This system produces a counterclockwise rotation of the occlusal plane, with opening of anterior bite during the retraction of the anterior teeth *(Fig. 6)*. The difficulty in the high-pull system is placing the miniscrews so far apically (10–11 mm above the archwire), due to the presence of abundant alveolar mucosa in that region.

In the presence of deep incisor overbites, the Authors prefer to open the bite by means of conventional mechanics, most commonly by means of a 0.019”x0.025” stainless steel archwire with an accentuated curve of Spee; then, when the incisor overbite has been corrected, the retraction of the anterior teeth is performed with medium-pull mechanics.

The material of the Dynforce archwire is heat-treated stainless steel. Heat treatment is performed on archwires after they have been given the arch form. Cold working produces stresses inside the material of the archwire. Heat treatment relieves the stress of the cold working, thus increasing the point of permanent deformation and the resilience of the archwire during clinical use. In other words, after heat treatment, the wires can withstand higher loads before permanent deformation sets in[2,21]. Food can impact on archwires and distort them during mastication, especially in the extraction area, where the span of the wire is longer. Distorted wires cannot slide through the brackets of premolars and molars during en masse retraction of front

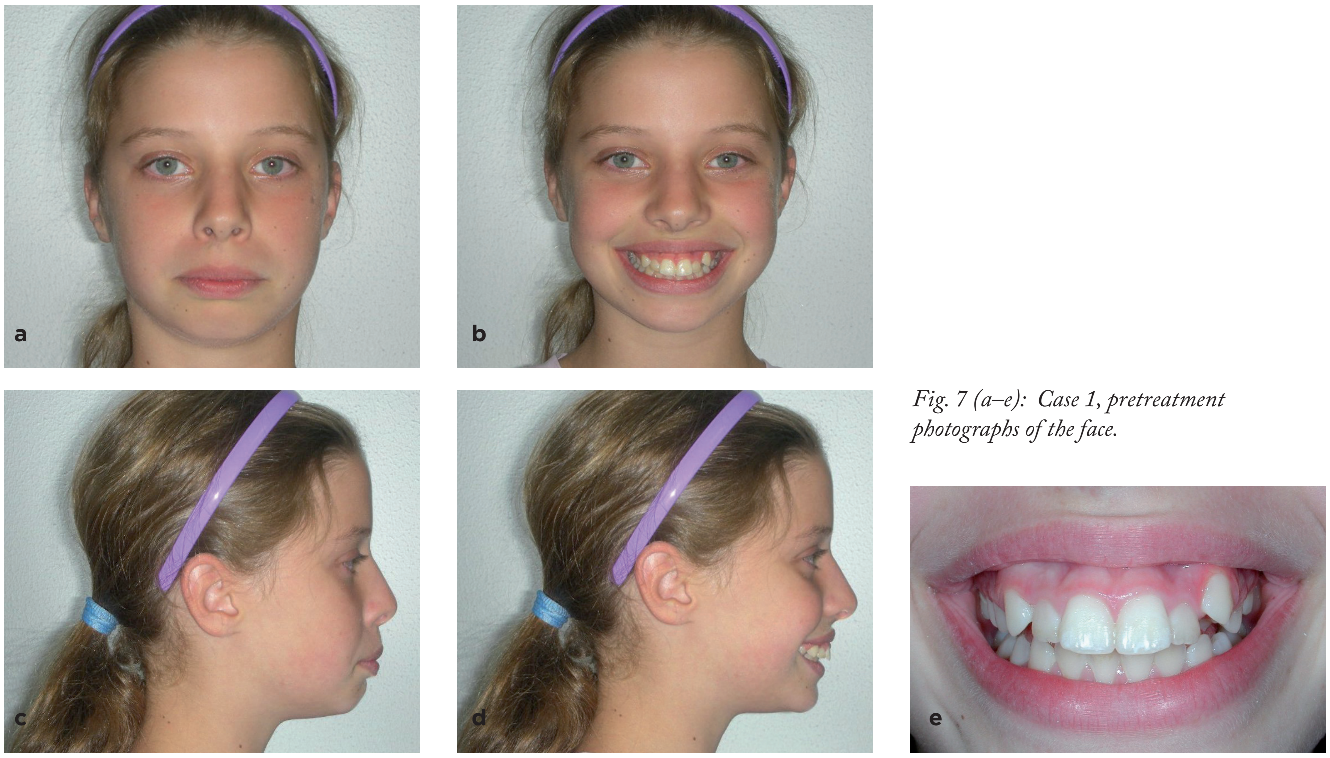

Fig. 7 (a–e): Case 1, pretreatment photographs of the face.

Fig. 7 (f–j) : Case 1, pretreatment intraoral photographs

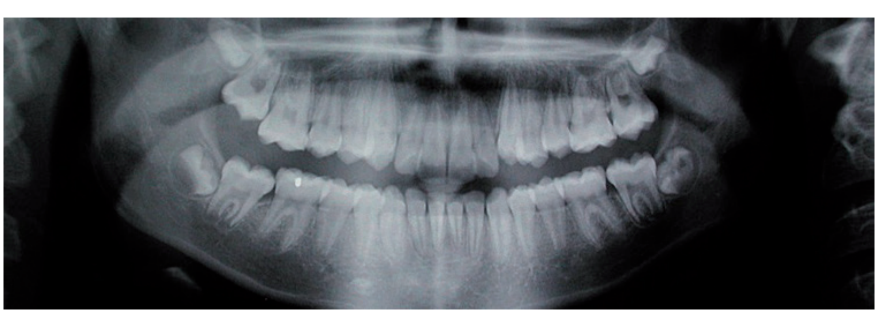

Fig. 8: Case 1, pretreatment panoramic radiograph.

Fig. 9 : Case 1, pretreatment lateral head film.

Fig. 10 : Case 1, pretreatment cephalometric tracing.

NORM ± S.D.	Pre-Treatment	Post-Treatment
SNA (82.0 ± 2.0)	82°	80°
SNB (80.0 ± 2.0)	77°	77°
ANB (2.0 ± 2.0)	5°	3°
A to Na_I_FH (0.0 ± 2.0)	5 mm	4 mm
Pog to Na_I_FH (-4.0 ± 2.0)	0 mm	3 mm
Convexity (A to N-Pog) (2.0 ± 2.0)	5 mm	4 mm
Wits (0.0 ± 2.0)	4 mm	0 mm
FMA (25.0 ± 3.0)	22°	22°
SN-GoGn (32.0 ± 4.0)	35°	35°
Maxillo-Mandibular Angle (28.0 ± 4.0)	26°	26°
Facial Axis (Ricketts) (90.0 ± 3.0)	89°	90°
Mx1 to A-Pog (4.0 ± 2.3)	11 mm	6 mm
Md1 to A-Pog (1.0 ± 2.3)	3 mm	3 mm
Mx1 - Palatal Plane (110.0 ± 5.0)	123°	118°
Md1 - Mandibular Plane (95.0 ± 5.0)	104°	104°
Interincisal Angle (132.0 ± 6.0)	106°	110°
Soft Tissue Analysis		
Facial Angle (G-Sn-Pog) (169.0 ± 4.0)	163°	166°
Upper Lip Thickness (12.6 ± 1.8)	8 mm	9 mm
Lower Lip Thickness (13.6 ± 1.4)	12 mm	11 mm
Upper Lip Protrusion (E line) (-4.0 ± 2.0)	2 mm	-2 mm
Lower Lip Protrusion (E line) (-2.0 ± 2.0)	4 mm	1 mm
Nasolabial Angle (102.0 ± 8.0)	106°	108°

Table 1: Case 1, pretreatment and posttreatment cephalometric analysis.

teeth. Heat-treated archwires are more resistant to this problem[2,21].

CASE REPORT 1

Diagnosis

The patient was 12.3 years old and her chief complaint was protruded and crowded dentition. She showed a convex profile, mentalis strain at swallowing, protruded upper and lower lips, gummy smile and protruded upper dentition *(Fig. 7a–e)*. Intraoral examination showed 8 mm overjet, moderate crowding in the upper arch, upper midline deviated to the right by 1 mm, Class II end-to-end relationship on the right side and full cusp Class II relationship on the left side *(Fig. 7 f–j)*.

Dental asymmetry was present in the upper arch: the upper left molar was more mesial than the contralateral molar *(Fig. 7i)*. The upper incisors were shifted to the right.

Pretreatment panoramic radiograph, lateral head film and cephalometric tracing are shown in *Figures 8, 9, 10*.

Cephalometric analysis *(Table 1)* revealed that the patient had a skeletal Class II malocclusion with mesofacial skeletal pattern, and protruded and proclined upper and lower incisors.

Treatment plan

The treatment plan was dental camouflage of the skeletal discrepancy. The upper first premolars were extracted to achieve a canine Class I relationship and molar Class II relationship. Maximum anchorage was required on the left side and medium anchorage on the right side. Minor crowding in the lower arch was relieved by means of air-rotor stripping (ARS).

Fixed appliances with a 0.022" slot and Roth prescription were utilized. Level/alignment phase was performed with 0.012" nickel-titanium archwires, 0.016"x0.022" nichel-titanium archwires and 0.019"x0.025" nichel-titanium archwires.

The en masse retraction of canines and incisors was performed with a low-friction Dynforce archwire (anterior segment, 0.021"x0.025"; posterior segments, 0.018"x0.022") and miniscrews.

Miniscrews were applied between the second premolars and first molars, 7 mm above the line of the brackets with hooks 6.5 mm long on the archwire (medium-pull mechanics). When a canine Class I relationship was achieved, the miniscrews were removed and space closure was finished with minimal anchorage. Asymmetrical anchorage (maximum on left side and medium on right side) was performed during treatment.

Treatment progress

After 6 months of treatment *(Fig. 11 a–d)*, en masse retraction of the anterior teeth was started with low-friction Dynforce archwire (anterior segment, 0.021”x0.025”; posterior segments, 0.018”x0.022”) and miniscrews. Maximum anchorage (direct anchorage from TADs) was used on the left and right sides. Note that the upper midline was deviated to the right (1 mm) and that the upper left premolar and molar were more mesial than the right ones.

After 8 months of treatment *(Fig. 12 a–d)*, a Class I canine relationship was achieved on the right side: the miniscrew was removed and the archwire hook was bent and cut. Asymmetrical anchorage was used: maximum anchorage on the left side (pull from the miniscrew) and minimal anchorage on the right side (power chain from archwire hook to molar bracket hook). Asymmetrical anchorage (maximum on the left and minimal on the right) was used to recreate symmetry in the upper arch and to move the upper midline to the left. Asymmetrical anchorage can be easily used with the Dynforce archwire when needed, with minimum chair-time.

After 9 months of treatment *(Fig. 13 a–d)*, a canine Class I relationship was achieved on both the left and right sides. The miniscrew was removed on the left side and space closure was continued with minimal anchorage on both the right and left sides. Dental arch symmetry and midline coincidence had been recreated.

The following can be seen:

- No posterior open bite and no anterior deep bite occurred during treatment (no clockwise rotation of occlusal plane) thanks to hooks 6.5 mm long (retracting force passing close to CR of the dental arch).
- Good control of incisor torque occurred – no prematurities with lower incisors – thanks to full-sized (0.021”x0.025”) anterior segment of the Dynforce archwire.
- Symmetry in the dental arch and midline coincidence were established thanks to asymmetrical anchorage *(Fig. 14 a–c)*.

When reciprocal anchorage is used, a piece of power chain with 6 O-rings is used (‘continuous’ type of power chain). If the overjet is not reduced by 1 mm a month, a piece of power chain with 5 O-rings is used. The power chain was changed every 5 weeks.

After 11 months of treatment *(Fig. 15 a–c)*, the finishing/detailing phase was performed with 0.019”x0.025” beta-titanium wires.

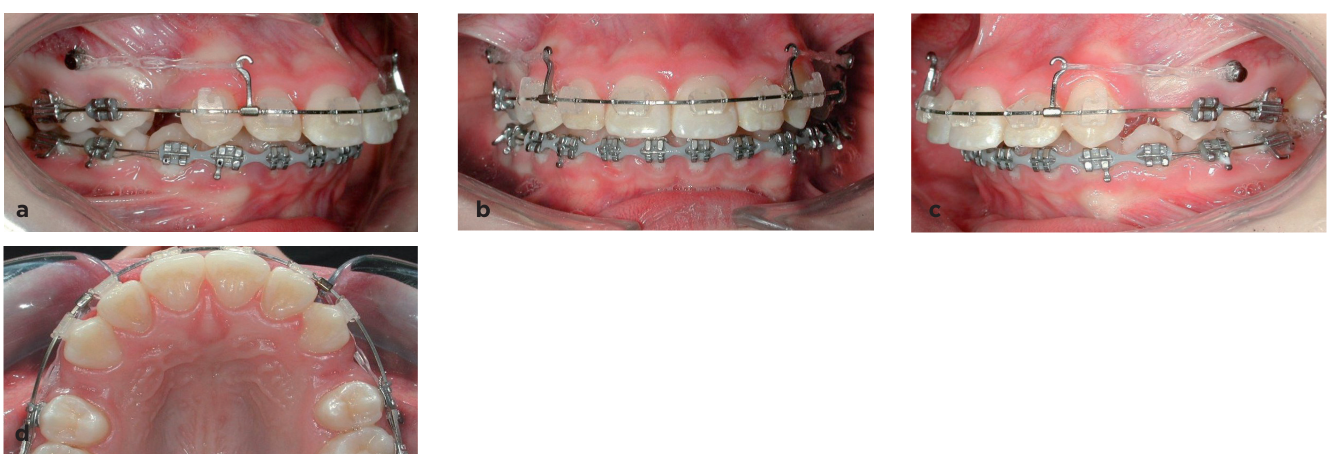

Fig. 11 (a–d): Case 1, progress, 6 months after start of treatment.

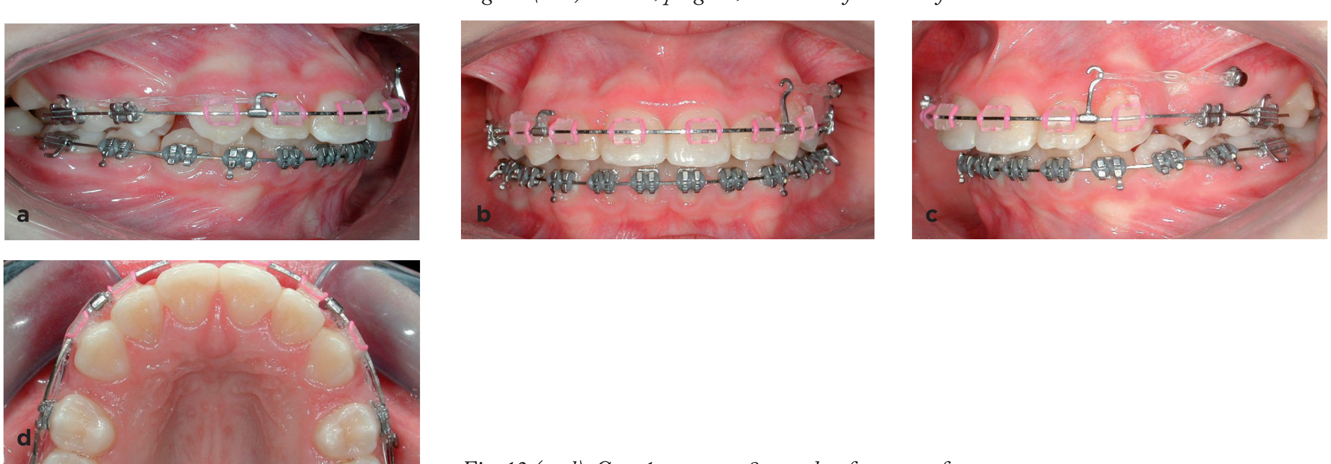

Fig. 12 (a–d): Case 1, progress, 8 months after start of treatment.

Figure 13 (a–d): Case 1, progress, 9 months after start of treatment.

Figure 14a: Case 1, initial occlusal photograph.

Figure 14b: Case 1, occlusal photograph after 6 months of treatment; start of en masse retraction.

Figure 14c: Case 1, occlusal photograph after 9 months of treatment.

Figure 15 (a–c): Case 1 after 11 months of treatment; finishing/detailing phase.

Figure 16 (a–e): Case 1, post-treatment photographs of the face.

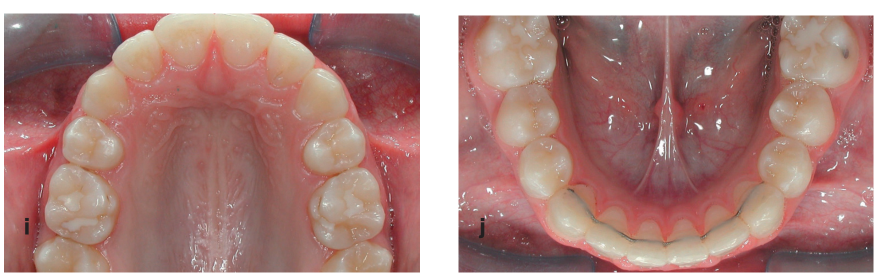

Figure 16 (f–j): Case 1, post-treatment intraoral photographs.

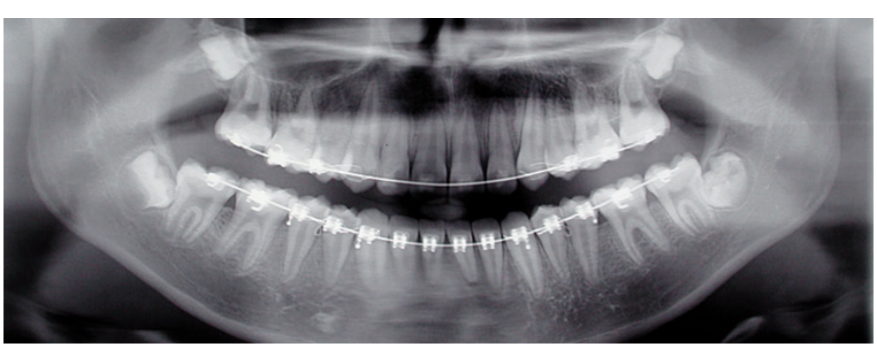

Figure 17: Case 1, panoramic radiograph taken 1 month before the end of treatment.

Figure 18: Case 1, lateral head film taken 1 month before debonding.

After treatment *(Fig. 16 a–j)*, the convexity of the profile was reduced. The upper midline shift and asymmetry of the upper dental arch were corrected. No cant of incisal plane occurred. The overjet was reduced from 8 mm to 2.5 mm. Gingival display was reduced and a relaxed lip seal was achieved.
Total treatment time was 13 months.
The panoramic radiograph taken one month before the end of treatment *(Fig. 17)* shows the root paralellism. The lateral head film taken one month before debonding *(Fig. 18)*, lateral cephalometric tracing *(Fig. 19)* and cephalometric superimpositions *(Figs. 20 and 21)* show the good control of incisor torque maintained during en masse retraction of the anterior teeth. Also, no rotation of maxillary occlusal plane occurred during treatment.

Dynforce archwire used with reciprocal anchorage

When medium-reciprocal anchorage is required, the Dynforce archwire is utilized without miniscrews.
In these clinical cases, the Authors prefer to use the Dynforce archwire with posterior segments with size 0.018”x0.025”, in order to contrast the bowing of the archwire. Canines and incisors are en masse retracted. Short (i.e. 2–3 mm long) hooks can be applied to the archwire. Elastic chains or active tiebacks are used to generate a Class I retracting force.
An accentuated curve of Spee is modelled on the Dynforce archwire when more incisor torque is required. An accentuated curve of Spee is modelled with the hands, not with pliers, in order to avoid indentations on the wire.

The Dynforce archwire thus ‘activated’ will have a deflection on the vertical plane of 2–3 mm. With accentuated curve of Spee, the anterior segment (0.021”x0.025”) is angulated, and will therefore increase incisor torque *(Figs. 2 and 22)*. Friction is kept at low levels because the posterior segments (0.018”x0.025”) of the Dynforce archwire have lower rigidity and hence lower coefficient of binding than conventional 0.019”x0.025” archwires.
Use of an accentuated curve of Spee is very useful when retraction of front teeth is performed on patients showing deep incisor overbite.
This type of mechanics utilized with the Dynforce archwire is showed in Case Report 2.

Figure 19: Case 1, posttreatment cephalometric tracing.

Figure 20: Case 1, superimposed pretreatment (black line) and posttreatment (red line) cephalometric tracings on sella-nasion line at sella.

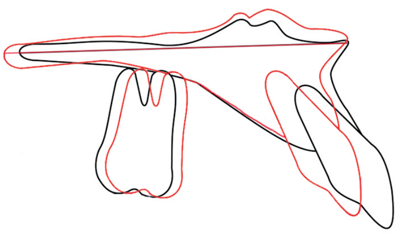

Figure 21 : Case 1, superimposed pretreatment (black line) and posttreatment (red line) cephalometric tracings on palatal plane and palatal curvature.

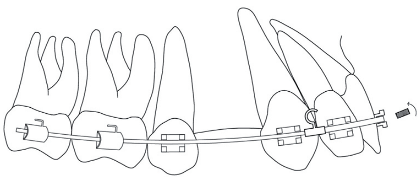

Figure 22 : Accentuated curve of Spee modelled on the Dynforce archwire to increase incisor torque.

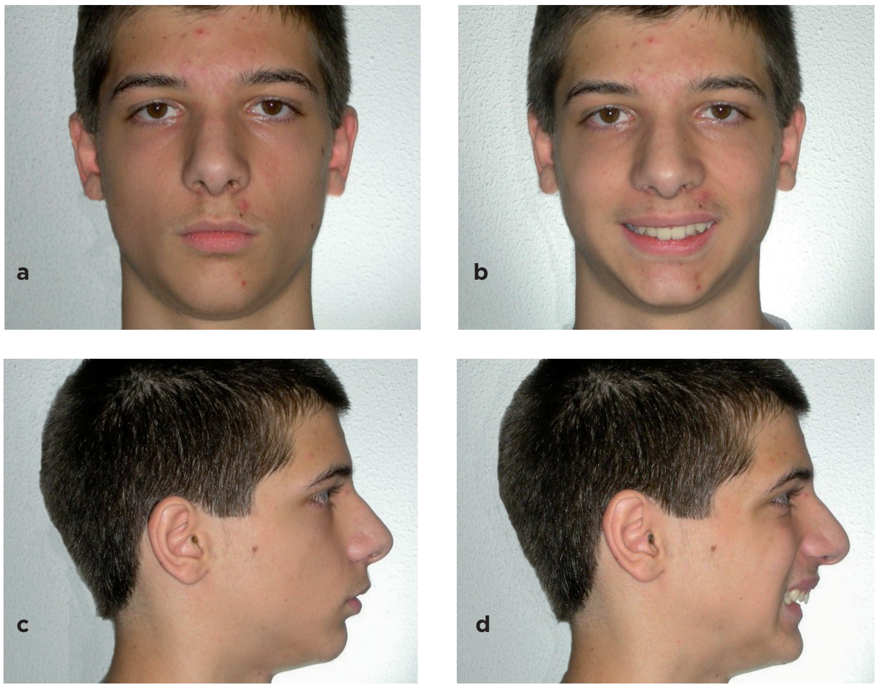

Figure 23 (a-e) : Case 2, pretreatment photographs of the face.

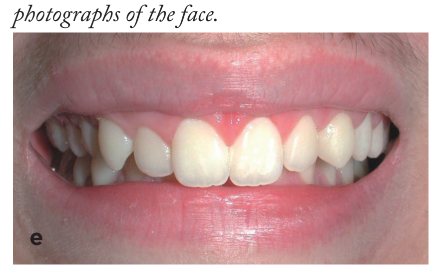

Figure 23 (f-j) : Case 2, pretreatment intraoral photographs.

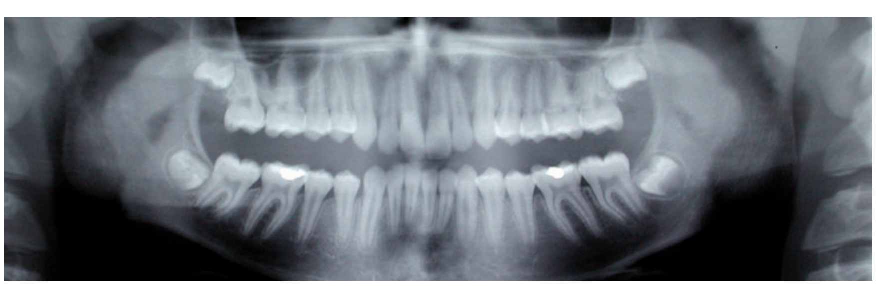

Figure 24: Case 2, pretreatment panoramic radiograph.

Fig. 25: Case 2, pretreatment lateral head film.

CASE REPORT 2

Diagnosis

The patient was 14.1 years old and his chief compliant was deep incisor overbite. The patient showed a convex profile *(Fig. 23 a-e).*

Intraoral examination *(Fig. 23 f–j)* revealed a traumatic incisor overbite. A scissor bite was present on the upper left first and second premolar. Full cusp Class II occlusion was present on the right and left sides. The panoramic radiograph *(Fig. 24)* revealed the absence of carious or periodontal lesions. Lateral head film, cephalometric tracing and cephalometric analysis *(Figs. 25–26)* showed severely over-erupted and upright upper incisors. The vertical skeletal pattern was mesofacial.

Treatment plan

The treatment plan was a dental camouflage of the skeletal discrepancy. The upper first premolars were extracted, to achieve a Class I canine and Class II molar relationship. Fixed appliances with a 0.022” slot and MBT prescription were utilized. An accentuated curve of Spee was modelled on the Dynforce archwire, in order to open the bite and to increase incisor torque, as explained in *Figure 22.* Upper arch asymmetry and scissor bite were corrected with archwires.

Treatment progress

Figure 27 a–c show indirect anchorage from miniscrews to the second premolars, and an elastic chain running from the second premolar to contralateral second premolars. A Dynforce archwire (anterior segment 0.021”x0.025”; posterior segments 0.018”x0.025”) with an accentuated curve of Spee was used. After 2 months, the miniscrews were removed and space closure was finished with reciprocal anchorage, with an elastic chain from the molar to contralateral molar.

After treatment *(Fig. 28 a–e)* an improved balance in the lip musculature at rest was achieved.

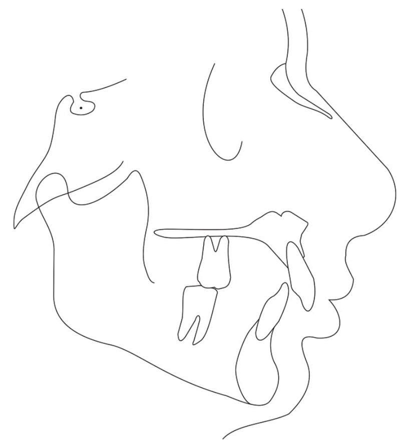

Fig. 26: Case 2, pretreatment cephalometric tracing.

Figure 27 (a–c): En masse retraction of anterior teeth (incisors and canines) performed with the Dynforce archwire with indirect anchorage from miniscrews.

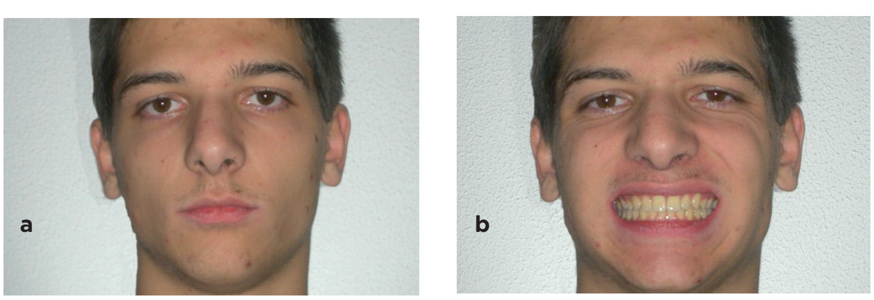

Figure 28 (a–e): Case 2, posttreatment photographs of the face.

Intraoral pictures (*Fig. 28 f–j*) show the increase of incisor torque and the bite opening effect achieved by means of an accentuated curve of Spee and full-sized anterior segment (0.021”x0.025”) of the Dynforce archwire. In deep overbite cases, the control of incisor torque is of paramount importance, in order to close extraction spaces and finish with a Class I canine relationship. The panoramic radiograph taken two years after treatment (*Fig. 29*) shows the root parallelism and the correct eruption of the upper third molars, occluding with the lower second molars.

Lateral head film, lateral cephalometric tracing after treatment and cephalometric superimpositions (*Figs. 30–33*) show the increase of incisor torque obtained with the treatment.

Incisor angulation relative to palatal plane was increased by 16°, as shown in the cephalometric analysis (*Table 2*).

CONCLUSIONS

The Dynforce archwire has shown its utility in controlling incisor torque and in minimising resistance to sliding during en masse retraction of front teeth.

In the case treated with maximum anchorage (direct anchorage from miniscrews), the presence of minimum wire-bracket play in the incisor region and the use of power arms 6.5 mm long positioned between the lateral incisor and canine achieved the objectives of obtaining bodily movement (translation) of incisors and avoiding the clockwise rotation of the maxillary occlusal plane.

The presence of posterior segments with lower coefficients of binding in the Dynforce archwire allows the use of lower Class I retracting forces, thus reducing the load on the miniscrews.

In the case treated with reciprocal anchorage, the use of an accentuated curve of Spee allowed generation of extra torque on incisors and efficient opening of the bite. The first case also shows the possibility of simultaneously using asymmetrical anchorage, maximum (from miniscrews) on one side and reciprocal on the other side, without canting the incisal plane.

Further, with this protocol, third-order bends are not utilised in the anterior region of the Dynforce archwire. Extra torque on incisors is achieved by means of an accentuated curve of Spee, so that the archwire can work on the flexible posterior segments.

This method is suitable for clinical use with ceramic brackets, which are less resistant to third-order bends.

Overall, the presence of edgewise rectangular cross sections in the three segments of the archwire allowed maintenance of good control of the arch form and of dental rotations during space closure.

Finally, the full-sized stainless steel wire (0.021”x0.025”) in the anterior segment of the Dynforce archwire, more rigid than the conventional 0.019”x0.025”, has not presented any particular problems regarding its insertion into the incisor brackets during clinical use, because precise alignment of bracket slots is achieved during the levelling phase.

Figure. 28 (f–j): Case 2, posttreatment intraoral photographs.

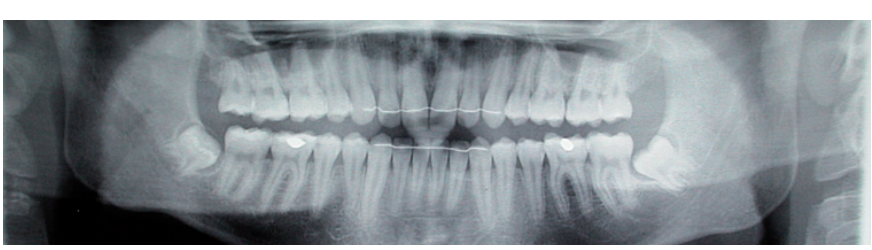

Fig. 29: Case 2, panoramic radiograph taken 2 years after treatment, showing correct eruption of upper third molars, occluding with lower second molars.

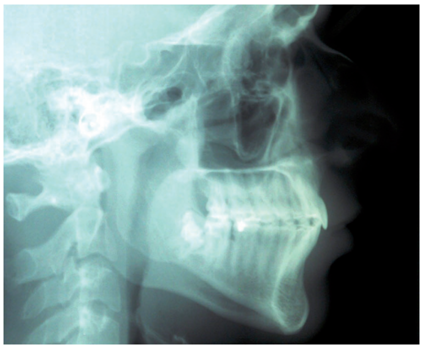

Figure 30: Case 2, posttreatment lateral head film.

Figure 31: Case 2, posttreatment lateral cephalometric tracing.

Figure 32: Case 2, superimposed pretreatment (black line) and posttreatment (red line) cephalometric tracings on sella-nasion line at sella.

NORM ± S.D.	Pre-Treatment	Post-Treatment
SNA (82.0 ± 2.0)	85°	80°
SNB (80.0 ± 2.0)	76°	76°
ANB (2.0 ± 2.0)	9°	4°
A to Na_I_FH (0.0 ± 2.0)	3 mm	0 mm
Pog to Na_I_FH (-4.0 ± 2.0)	-6 mm	-5 mm
Convexity (A to N-Pog) (2.0 ± 2.0)	7 mm	3 mm
Wits (0.0 ± 2.0)	9 mm	6 mm
FMA (25.0 ± 3.0)	23°	23°
SN-GoGn (32.0 ± 4.0)	31°	32°
Maxillo-Mandibular Angle (28.0 ± 4.0)	26°	27°
Facial Axis (Ricketts) (90.0 ± 3.0)	89°	88°
Mx1 to A-Pog (4.0 ± 2.3)	5 mm	4 mm
Md1 to A-Pog (1.0 ± 2.3)	-1 mm	1 mm
Mx1 - Palatal Plane (110.0 ± 5.0)	96°	112°
Md1 - Mandibular Plane (95.0 ± 5.0)	99°	101°
Interincisal Angle (132.0 ± 6.0)	139°	121°
Soft Tissue Analysis		
Facial Angle (G-Sn-Pog) (169.0 ± 4.0)	154°	158°
Upper Lip Thickness (12.6 ± 1.8)	12 mm	13 mm
Lower Lip Thickness (13.6 ± 1.4)	15 mm	14 mm
Upper Lip Protrusion (E line) (-4.0 ± 2.0)	-2 mm	-4 mm
Lower Lip Protrusion (E line) (-2.0 ± 2.0)	0 mm	-1 mm
Nasolabial Angle (102.0 ± 8.0)	112°	106°

Table 2: Case 2, pre treatment and post-treatment cephalometric analysis.

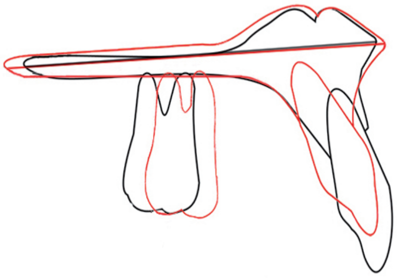

Figure 33: Case 2, superimposed pre treatment (black line) and post-treatment (red line) cephalometric tracings on palatal plane and palatal curvature.

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Introduction to Clinical Studies

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In the previous article, we dealt with the hierarchy of clinical trials.

Now we are going to describe the different types of studies (study designs).

In the first place, it is necessary to distinguish between *observational studies* and *experimental studies*.

If an investigator designs a research protocol and carries out the treatment, the study is referred to as an *experimental study;* but if the investigator only observes a phenomenon (treatment, course of illness, etc.) the study is referred to as an *observational study*.

The next step is to assess whether the study includes comparison with a control group.

Experimental studies are divided into *controlled trials* and *non-controlled trials.*

Observational studies are divided into *analytical studies*, which include a comparison group, and *descriptive studies* with no comparison group.

Descriptive studies do not include statistical analysis but only a simple description of a phenomenon (a treatment, a disease, a technique, etc.) In this case, we call it a *case report* - or a *case-series*, if it includes more than one patient.

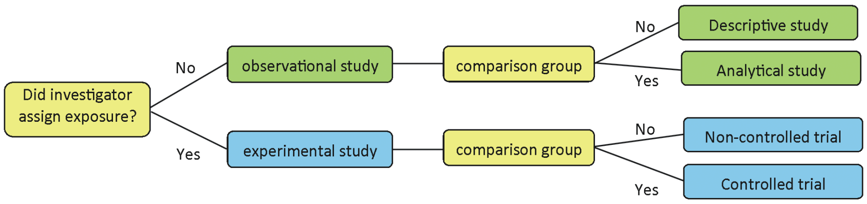
The distinction between the different types of analytical studies depends on the relationship between exposure and outcome.

Exposure is a risk factor or a treatment (e.g. smoking, gender, oral breathing, an orthodontic appliance, etc.) The *outcome* is the result of exposure (periodontal disease, malocclusion, correction of malocclusion, etc.)

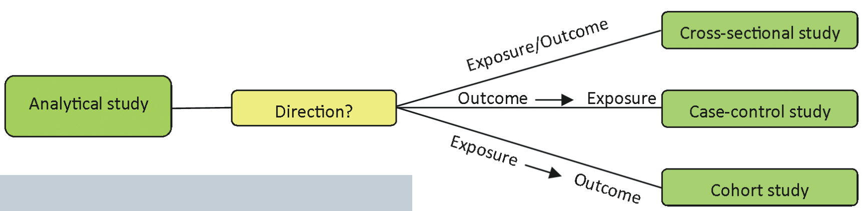
If an investigator selects all the children attending a school class and assesses how many of them are mouth breathers (exposure) and how many are nasal breathers, and he subsequently assesses the occurrence of maxillary contraction (outcome) in both groups, exposure and outcome are assessed at the same time. This study is referred to as a *cross-sectional study*.

If an investigator selects a group of children with maxillary contraction (outcome) and a comparison group with normal development of the maxilla, and then assesses how many of them used to be mouth breathers (exposure) in both groups, this study is referred to as a *case-control study*.

If an investigator selects a group of children who are mouth breathers (exposure) and a control group of nasal breathers and then assesses how many of them in both groups subsequently develop maxillary contraction (outcome), this is referred to as a *cohort study.*



Algorithm for classification of types of clinical research



Algorythm for classification of analytical studies

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X-RAY ODDITIES

Many times, when we see in our practice a radiograph, we have the opportunity to note images that may or may not influence directly our diagnosis and our treatment plan.
This column of EJCO gives us the opportunity to show these images and to make some brief observations about them. The style is concise: the images largely speak for themselves.
Your suggestions for future topics as well as your comments will be very welcome.

The Unerupted Deciduous and the Hidden Bicuspid

The patient, a 12-year-old boy, was referred to the orthodontist for the correction of a Class II malocclusion. Clinical examination revealed an occlusal situation of late mixed dentition.
The upper right first molar was in contact with the first deciduous molar and there was no space for the eruption of the second bicuspid. On the left upper side, first and second deciduous molars were present but the second molar showed clinical signs of infraocclusion.
Panorex of the upper arch showed the impaction of 55, a mucous retention cyst of the right maxillary sinus and the apparent absence of 15 (*Fig. 1*).
Sagittal and axial slices of cone beam showed the presence of 15 positioned posterior with respect to the impacted deciduous molar. Moreover, 15 appeared to be in a horizontal position (*Figs. 2,3*).

OBSERVATIONS

Infraocclusion of deciduous molars is a common occurrence in humans, but primary failure of eruption of deciduous teeth is rare[1-3]. When this occurs, it almost always affects the second molars and ankylosis probably has a leading role in the aetiopathogenesis[4].
In most cases of primary failure of eruption of deciduous teeth, ectopically placed permanent teeth and taurodontism of permanent molar teeth are evident[5].
Primary failure of eruption of deciduous and permanent teeth has been attributed to abnormalities in the periodontal ligament structures related to eruption[6].

CONCLUSION

In case of primary failure of eruption of a deciduous molar, the association with an ectopic position of the corresponding permanent tooth and with the tendency of the first permanent molar to tilt mesially, closing the space for the eruption of the second bicuspid, often make orthodontic treatment necessary.
Moreover, the impaction of a deciduous molar complicates the process of surgical removal. Therefore, in consideration of the child's age and emotional maturity, it should be decided to perform surgical removal of the unerupted tooth under general anaesthesia.

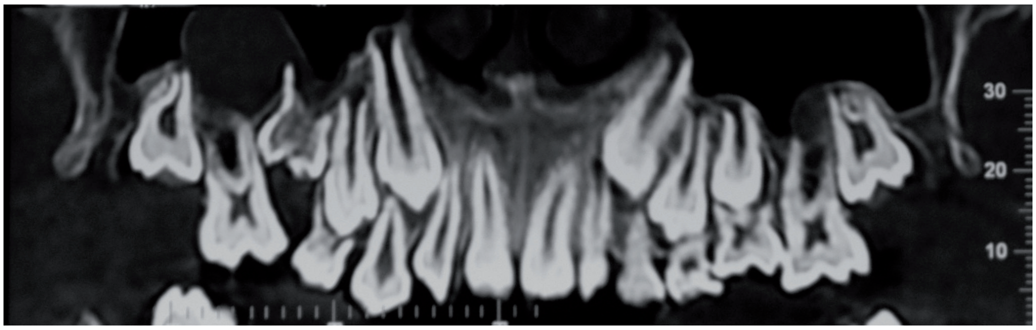

Figure 1: Panorex showing 55 impacted, a cyst in the right maxillary sinus and the infraocclusion of 65.

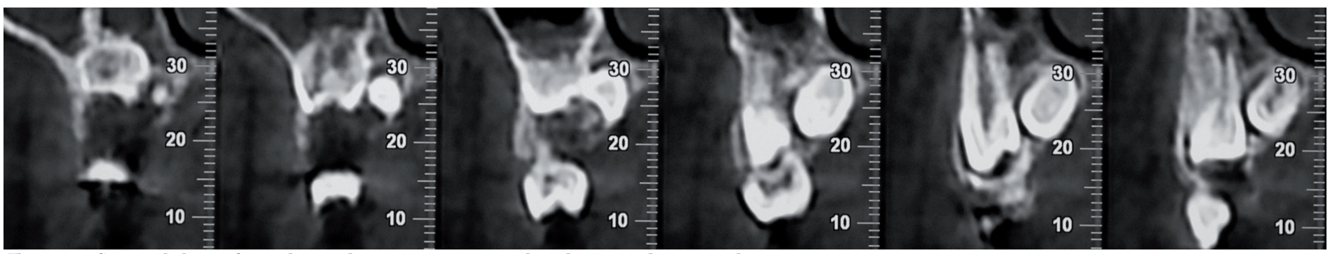

Figure 2: Sagittal slices of cone beam showing 55 impacted and 15 in a horizontal position.

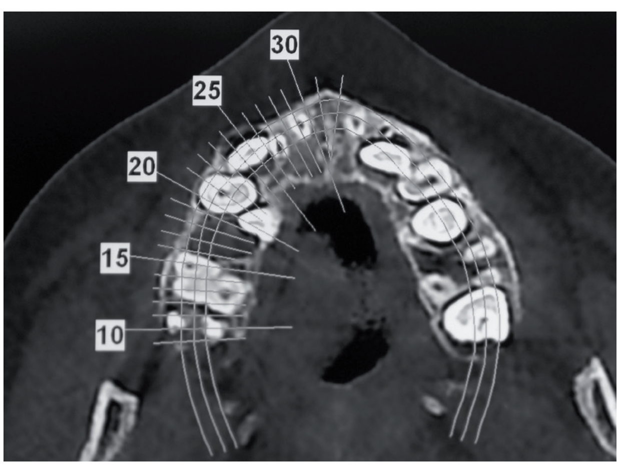

Figure 3: Axial slice showing 15 positioned posterior respect 14

Images courtesy of Studio Radiologico D'Ambrosio, Rome, Italy

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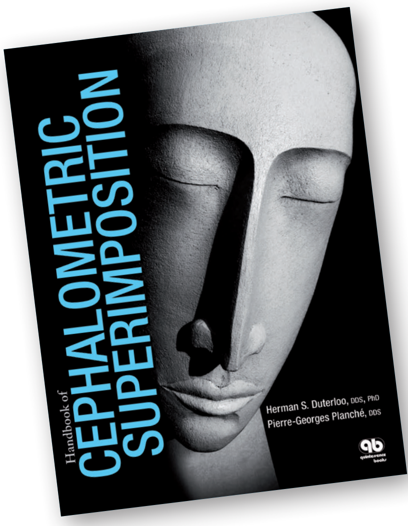
BOOK REVIEW

Handbook of Cephalometric Superimposition

R. Schiavoni
Editor-in-Chief



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Schiavoni R. Bookreview: Handbook of Cephalometric Superimposition, EJCO 2014;**2:**66;doi:10.12889/2014_G00024

The state of the art of the structural superimposition method, introduced by Bjork, to whom this book is dedicated, is the main theme of this great work.

Superimposition methods have a long history and many different references have been introduced: all these procedures are based on the use of periosteally located landmarks. All traditional cephalometric landmarks are unstable and change position with growth and treatment. This can make interpretation of changes between pretreatment and posttreatment unreliable and may cause misinterpretation of growth and treatment.

The structural method of superimposition is based on longitudinal Bjork implant studies; it has a scientific basis because of the nature of the references used. It is the only evidence-based method.

However, there are two problems inherent to this method: technical difficulties in its execution and the time needed to follow the procedure correctly. For these reasons, the last two chapters should be "studied" with the greatest care. They contain up-to-date, new recommendations for application of traditional and digital techniques to prepare accurate and reliable superimpositions.

Moreover, this book contains:

- Three extraordinary chapters that explain how to interpret growth, growth patterns and treatment changes and how to describe them.
- A chapter that describes with great accuracy how to interpret radiographic image variations.

As the Authors say, "the correct description and a logical explanation of records greatly enhance communication with patients and between colleagues".

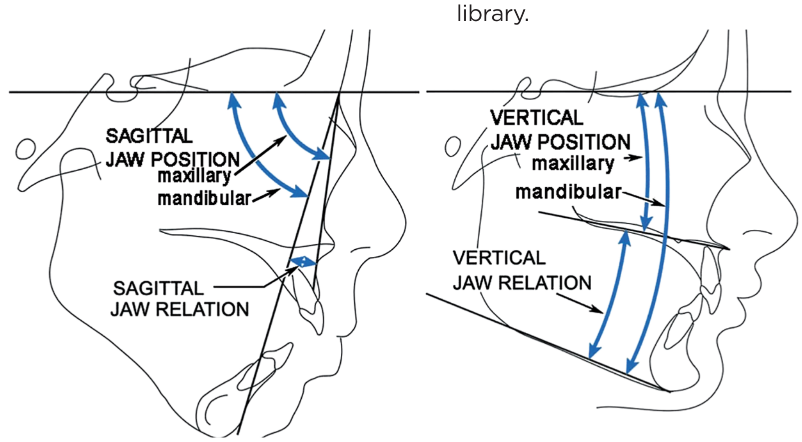
At the same time, they underline that "serial cephalograms are not indicated for each orthodontic patient. The procedure is justified in patients only where there is an established indication for diagnosis and evaluation of growth and treatment by cephalometrics."

"The ALARA principle should be applied at all times – that is, the radiation dose should be "as low as reasonably acceptable". This implies that radiographs should have a tangible benefit for the individual patient."

This concept has great ethical value.

Like it or not, cephalometric data and superimpositions are still an indispensible means for the clinician. :

In my opinion, there are many reasons to include this elegant book in your library.



Different Measurements to espress sagittal and vertical position of the jaws

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