

The Debate Over Lower Incisor Proclination and Gingival Recession

Part 1: Introduction

When I was an orthodontic resident in 1979 we were taught to treat to an upright lower incisor. The only expansion allowed was sutural expansion with an RME.

The "shared belief" was that lower incisor proclination would result in gingival recession.

In the 1980's my Class II patients fell into four groups.

1. Orthodontic decompensation and jaw surgery,
2. Two phase non-extraction beginning with a functional appliance (which evolved into Herbst followed by Xbow),
3. One phase four bicuspid extraction and headgear,
4. One phase upper bicuspid extraction.

One thing became clear. If I extracted four bicuspids in a deep overbite case, I ended up chasing the lower incisors in what I call the "never ending overjet". It was in these cases where I saw the most lip retraction, or profile flattening.

I began treating more and more of these cases non-extraction and in two phases.

No matter which interarch Class II appliance I used, I proclined lower incisors. Whether it was Xbow or Herbst or Twin Block or Class II elastics or Forsus, it didn't matter. Expand buccally? Interproximal reduction?

Fill the slot and tie back? Minus six degree lower incisor brackets? They still proclined.

I didn't worry about proclining lower incisors with functional appliances until I began using Herbst.

(So this is what happens with full time wear.) Even then, I didn't see any gingival recession which agrees with the article by Hans Pancherz and a systematic review on proclination. I am more comfortable with lower incisor tipping followed by partial uprighting with Xbow and non-edgewise Herbst, than I am with bodily mesialization

with a rectangular archwire and minus six degree lower incisor brackets, which I find results in root prominence.

Dr. Anthony Mair explains it this way: **"It is better to tip the crown and leave the root in bone than to bodily move the root out of bone; this setup is more reflective of natural compensation."**

Dr. Mair has recently reported on several cases where Class II elastics used against a lower aligner caused bony dehiscence due to bodily movement of the lower incisors. The solution was to torque the root apex back into alveolar bone as recommended by Dr. Laursen et al (Am J Orthod Dentofacial Orthop 2020;157:29-34)

Dr. Mair warned that we should prepare for more of these cases as the popularity of Class II elastics used with aligners increases.

Part 2: The history involving my 40 years as an orthodontist

1979-1981: I was an orthodontic resident at Indiana University. Class II's were treated by bicuspid extraction and headgear. Class II elastics were discouraged. We heard Drs. Rocke and Kesling speak on treating non-extraction with Class II elastics. They showed ceph tracings similar to what other orthodontists were achieving with functional appliances such as activators, bionators, and Frankel appliances. It was a combination of skeletal and dental effects including lower incisor proclination.

Dr. Ricketts was making an impact on our profession when he introduced the soft tissue analysis and the "Esthetic Plane". He said that over-extracting could be detrimental to the face. He suggested that lower crowding in a deep bite was related to the lower arch being contained by a constricted upper arch.

The lower incisor tends to be more proclined in low mandibular plane angle cases with normal overbite and more upright in high mandibular plane angle cases with normal overbite. Dr. Ricketts taught that four bicuspid extraction should be done more in high angle cases with a shallow overbite. Low angle cases with deep overbite should be treated non-extraction.

1981: Dr. Behrents published the ground breaking article in the Journal of Periodontology that was the first to debunk myths that I had been taught.

J. Periodontology June, 1981

The Width of Keratinized Gingiva During Orthodontic Treatment: Its Significance and Impact on Periodontal Status

Gary W. Coatoam, Rolf G. Behrents and Nabil F. Bissada

The results of the study revealed: 1) Increases in the width of the keratinized gingiva may occur on some teeth during the course of orthodontic therapy; 2) Statistically significant increases in the clinical crown during orthodontic therapy are not reflected in statistically significant decreases in the width of keratinized gingiva; 3) Minimal widths of keratinized gingiva (less than 2 mm) are capable of withstanding the stresses of orthodontic mechanics; 4) Teeth that are lacking in any keratinized gingiva prior to orthodontic treatment will not form any new keratinized tissue during the course of orthodontic therapy; 5) Mucogingival problems noted after orthodontic therapy are often the result of a pre-existing mucogingival problem; 6) Changes in the dimensions of the keratinized gingiva correlated statistically with the orthodontic movement of the maxillary central incisors ($P < 0.001$) and, with the maxillary and mandibular cuspids ($P < 0.02$).

1981-1984: I was an associate with my mentor, Dr. Michael Wainwright. He taught me indirect bonding, two phase treatment, and combined orthodontic/orthognathic surgical treatment.

1984: I opened my office in North Delta. I began using functional appliances. I took a ceph at the final records.

I was proclining lower incisors with the functional appliances, but I was not seeing gingival recession. This became a subject that would interest me for my entire career.

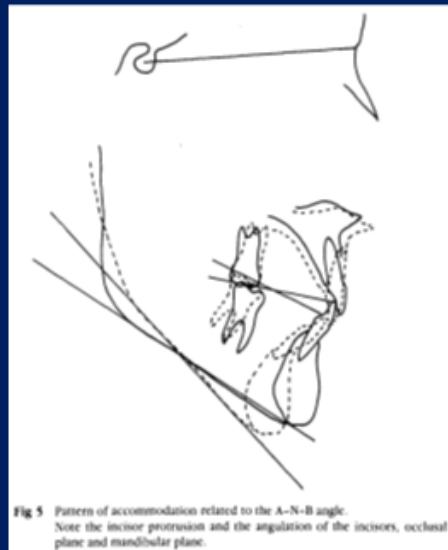
Dr. Casco published his findings that questioned Tweed's 95 degree IMPA in untreated Class II skeletal patterns with Class I occlusions. More myth debunking.

Dental and Skeletal Variation Within the Range of Normal

JOHN S. CASKO, WALTER B. SHEPHERD

The Angle Orthodontist: 1984, Vol. 54, No. 1, pp. 5–17.

Untreated Class II and Class III Skeletal Sample
with Ideal Occlusion
(*Naturally Compensated*)



Pattern of Accommodation: “When the ANB angle is high, the mandibular plane angle is steeper, the cant of the occlusal plane is high and the incisors are more upright in the maxilla and more protrusive in the mandible.”

Table 2

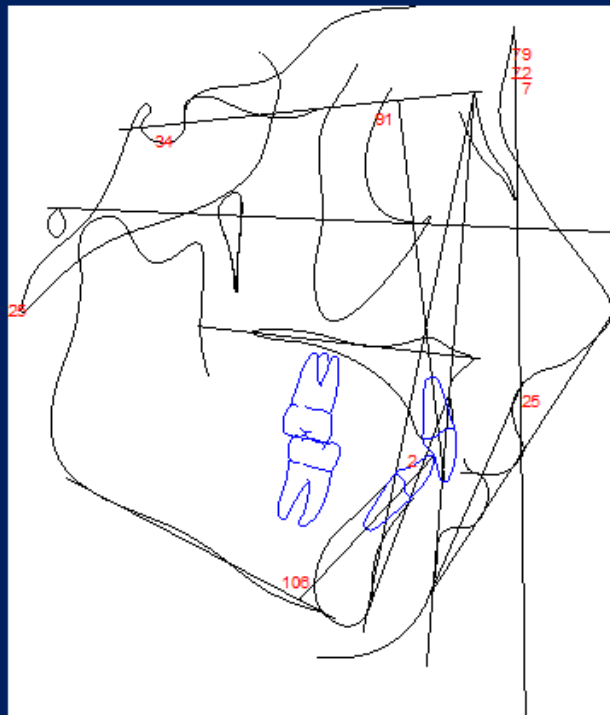
Ideal occlusion sample
Ranges, means, modes and standard deviations

	Low	Mean/Mode	High	Range	S.D.
<u>A-N-B</u>	-3	1.9/3.0	<u>8</u>	11	2.1
S-N/MP	15	29.2/27.0	41	26	5.7
FH/N-Pog	79	87.9/88.0	95	16	3.6
UI/LI	107	126.2/120.0	154	46	9.7
<u>UI/S-N</u>	<u>93</u>	107.4/108.0	120	27	5.9
LI to A-Pog (mm)	-4	2.2/1.0	6	10	2.1
FMA	16	23.7/24.0	35	19	4.7
<u>IMPA</u>	83	96.8/106.0	<u>106</u>	23	6.0
FMIA	46	59.8/62.0	<u>75</u>	29	6.6

Dr. Casco believed that incisor inclination was linked to the skeletal pattern and showed that it was normal for the lower incisor to have an IMPA higher than 95 degrees in an untreated skeletal Class II with a Class I occlusion.

He argued that this should be the goal for Class II compensation.

Example from my practice:



Naturally occurring Class II skeletal with Class I dental and a retroclined upper incisor and proclined lower incisor

Dr. Creekmore agreed with Dr. Casko.

Tom Creekmore

“Studies of untreated good occlusions and faces have shown that the position of the mandibular incisors within the mandible compensates for differences in the anterior/posterior relationship of the jaws much more than the position of the maxillary incisors on the maxilla. This means that the position of the maxillary incisors in the maxilla is a better determinant of where the teeth belong in the face than the position of the mandibular incisors in the mandible for patients with above or below average skeletal frameworks”

1990: My study club invited Dr. William Clark to speak to us about twin blocks. I began using them.

1991: Dr. DeVincenzo publishes his research which is the first of many to question the ability of functional appliances to increase mandibular length in the long term. Dr. Lysle Johnston coined the term "mortgaging mandibular growth".

More myth debunking.

March 1991 • Volume 99 • Number 3

Changes in mandibular length before, during, and after successful orthopedic correction of Class II malocclusions, using a functional appliance

John P. DeVincenzo, DDS, MS
Loma Linda, Calif.

Highly significant increases in mandibular length still present 2 years after functional orthopaedic treatment, diminished but still significant gains after 3 years, and no significant difference after 4 years.

Am J Orthod Dentofacial Orthop 1991;99(3):241-57.

1995: I began using the four crown Herbst appliance which got me interested in non-compliance appliances.

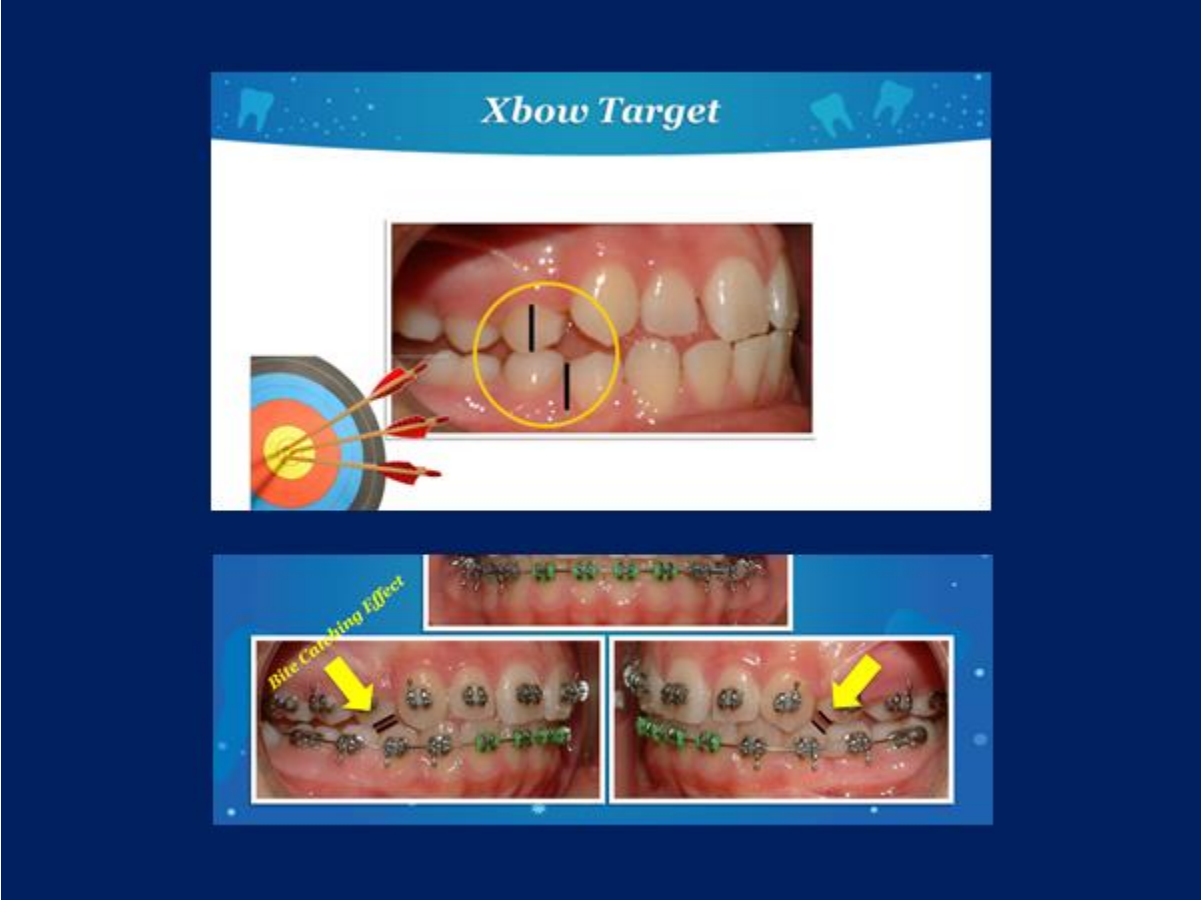
My main concern was with over-correction I was seeing noticeable lower incisor proclination that I had not noticed with removable functional appliances. I tried placing -5 to -10 degree lower incisor brackets but instead of proclining the lower incisors I noticed that the bodily mesialization of the incisors resulted in a "dashboard effect". I preferred tipping the lower incisors temporarily and then allowing them to upright before phase two.

The important thing was I did not see the gingival recession that I had been taught would happen.

Dr. Alan Lowe developed the Klearway appliance for snoring and sleep apnea. Long term wear has resulted in severe proclination of lower incisors without significant recession.

1997: Dr. Pancherz published his summary of the effects of the Herbst appliance. There was no long term increase in mandibular length. He did not recommend it in non-growing patients, possibly due to the risk of condylar resorption, which he had shown. (Dr. Woodside also showed condylar resorption with the Herbst appliance. When I lectured at the University of Toronto, Dr. Woodside commented that the Crossbow Appliance was probably kinder to the condyle than the Herbst appliance because the springs were stress breakers and allowed the condyle to function in the fossa.)

The take away message was that mixed dentition treatment was not recommended because "a stable cuspal interdigitation after therapy is difficult to achieve and relapses are prone to occur." Pancherz had proven what Dr. Herbst called "the bite catching effect".



Thanks to Dr. Herb Hughes for the above slide showing over-correction with Xbow and the bite catching effect of the steep cuspal inclines of the first bicuspids.

Pancherz, H. **The effects, limitations, and long-term dentofacial adaptations to treatment with the Herbst appliance.** *Semin Orthod.* 1997; 3: 232–243

The purpose of this article is to summarize the existing scientific data with respect to the short- and long-term effects of the Herbst appliance on the occlusion and on the maxillo/mandibular complex. The article also discusses the treatment indications and possible treatment limitations. The Herbst method is most effective in the treatment of Class II malocclusions. Long-term stability seems to be dependent on a stable cuspal interdigitation. Marked mandibular morphological changes occur during therapy and sagittal condylar growth is increased. **Posttreatment, most of the mandibular morphological changes revert and no long-term influence of Herbst treatment on mandibular growth can be verified.** The appliance effect on the maxillary complex can be compared with that of a high-pull headgear. Without proper retention, however, this effect is of a temporary nature. Herbst treatment is especially indicated in the permanent dentition at or just after the pubertal peak of growth. Mixed dentition treatment is not recommended, as a stable cuspal interdigitation after therapy is difficult to achieve and relapses are prone to occur. In the nongrowing patient, the appliance should be used with great caution.

1998: Dr. Jay Bowman published an article in the JCO using Jasper Jumpers attached to a lower lip bumper instead of a bypass. I was convinced that most Class II's required maxillary expansion. I was also using lower lingual arches to preserve the "e" space. I added a lip bumper and Ormco's Bite Fixer springs. This led to the Xbow appliance.

Dr. Pancherz publishes his findings on the Herbst appliance and gingival recession.

Does orthodontic proclination of lower incisors in children and adolescents cause gingival recession?

S Ruf, K Hansen, H Pancherz

“No interrelation was found between the amount of incisor proclination and the development of gingival recession.”

“This phenomenon may have been due to the fact that an approximately 80% spontaneous reversal of the incisor proclination after Herbst treatment occurs.”

American Journal of ORTHODONTICS
and DENTOFACIAL ORTHOPEDICS

July 1998 • Volume 114 • Number 1

Lessons from Herbst... and Hans Pancherz

- Over-proclination of the lower incisors followed by partial rebound does not cause gingival recession.

2000: Dr. Gianelly gives us a target to shoot for.

Mandibular “E” space preservation

“...76% of patients can be treated non-extraction if the e-space is saved ... and if one is willing to accept no more than 1 mm of arch length expansion.”

Gianelly - AJODO 2000

2001: Granted a US patent and registered trademarks for the Xbow

2002: I lectured on the Xbow appliance with Dr. Pancherz at the GLAO/MASO meeting. We discussed lower incisor proclination and agreed that temporary over-proclination followed by uprighting did not cause gingival recession and in fact over-correction followed by the bite catching effect and cuspal interdigitation was necessary for long term stability.

2009: First Xbow research paper published in the AJODO after working with Dr. Carlos Flores-Mir at the U of Alberta.

We showed the lower incisor proclined a similar amount to the Herbst appliance. A total of seven papers on Xbow would be published as a result of Dr. Flores-Mir's effort.

Orthodontic therapy and gingival recession: a systematic review

Joss-Vassalli I, Grebenstein C, Topouzelis N, Sculean A, Katsaros C

The amount of recession found in studies with statistically significant differences between proclined and non-proclined incisors is small and the clinical consequence questionable.

Orthod Craniofac Res 2010;13:127–141

2013: Drs. Bob Miller and Carlos Flores-Mir publish the definitive research paper on the efficiency of two phase Xbow treatment compared to one phase Forsus to the arch wire treatment.

Incisor inclination changes produced by two compliance-free Class II correction protocols for the treatment of mild to moderate Class II malocclusions.

Miller et al.
Angle Orthod 2013



Original Article

Incisor inclination changes produced by two compliance-free Class II correction protocols for the treatment of mild to moderate Class II malocclusions

Robert A. Miller, Long Tieu, Carlos Flores-Mir

ABSTRACT

Objective: To compare the changes in incisor inclination between two compliance-free Class II correction protocols for the treatment of mild to moderate Class II malocclusions.

Materials and Methods: Among Class II malocclusion patients a total of 36 consecutive patients treated with the Xbow appliance and later with full brackets (XB) were compared to 36 consecutive patients treated with Forsus connected to the archwire with full brackets (FC). Evaluated cephalometric variables were overjet, overbite, skeletal Class II, lower incisor inclination, and upper incisor inclination. Factors that were analyzed were gender, treatment type, age at start of treatment (T1), and treatment length. Independent t-tests, χ^2 , multiple analysis of variance, and Pearson correlations were applied.

Results: No differences in incisor inclination between both treatment protocols were identified. At T1 no statistical difference for any cephalometric variable was demonstrated with regard to gender and treatment type. Gender was also not associated with a different treatment time or age at T1. The mean treatment time was 24.2 months for XB and 30.2 months for the FC group ($P = .037$). XB patients averaged 10 fewer months of fixed edgewise appliances compared to FC patients. Neither gender nor treatment type had any influence on the changes of the evaluated dependent variables between T1 and the end of treatment. Lower incisors proclined more the longer the treatment ($P = .002$). Both overall and upper incisor inclination were affected by age at T1 ($P = .001$ and $P = .014$, respectively).

Conclusions: Both compliance-free Class II correction protocols for the treatment of mild to moderate Class II malocclusions appear to generate the same amount of incisor inclination. Large variability was identified. (Angle Orthod 2013;83:431-436.)

KEY WORDS: Xbow, Forsus, incisor inclination

INTRODUCTION

The controversy over lower incisor proclination from treating the Class II nonextraction patient persists today. While some authors¹⁻³ claim that the gingivo-odontorhinal

condition is worsened in patients who undergo incisor proclination, others⁴⁻⁶ have found no association between Class II mechanics and gingival recession in bone loss. In the regard Herbst⁷ appliances, the nonpopular "side jumping" Class II correctors, have been studied⁸ and no before increase in gingival recession was found in treated adolescents and children. Even concerning the same authors⁹ have suggested avoiding proclining incisors in adults because of a lack of evidence of these factors. To corroborate this, continuing two systematic reviews^{10,11} have explored all of the available evidence. Both concluded that there is no strong clinically important association between the degree of incisor proclination and increased gingival recession. The authors of these studies hypothesized that it is the combination of thin attached gingival coverage, poor oral hygiene, and inflammation that facilitates incisor gingival recession when proclining teeth.

DOI: 10.1097/00007122-201308000-00011

Angle Orthodontist 83:83, No. 5, 2013

Conclusions

- The Xbow two phase protocol averaged 6 fewer months of overall treatment and 10 fewer months of fixed edgewise appliances compared to the Forsus to the archwire single phase protocol. (26.75 months for the Forsus to the archwire group vs 16.68 months for the Xbow group)



Conclusions (2)

- No differences in incisor inclination between treatment protocols were identified.
- Lower incisors proclined more the longer the treatment.



2015: The data from 172 consecutively treated Xbow patients was studied at the U of Alberta. An interesting finding was that the average initial lower incisor inclination was 99 degrees. This agrees with Dr. Casco's belief that Class II skeletal cases are naturally compensated.

Lower Incisor Inclination during Class II Malocclusion Treatment with the Xbow Appliance followed by Fixed Appliances

Fern Leavens (4th year dental student)
Summer Research Project (2015)
Under the supervision of Dr. Flores-Mir
Unpublished



- 172 consecutively treated patients
- T_1 - T_2 = phase one Xbow, T_2 - T_3 = phase two full edgewise
- The mean lower incisor inclination changed from T_1 (99.1°) to T_2 (102.2°), with a mean difference of 3.1° . The change is statistically significant ($p < 0.001$).
- The mean lower incisor inclination changed from T_2 (102.2°) to T_3 (103.7°), with a mean difference of 1.5° . The change is statistically significant ($p = 0.01$). This may not be clinically significant.
- The mean lower incisor inclination changed from T_1 (99.1°) to T_3 (103.7°), with a mean difference of 4.6° . The change is statistically significant ($p < 0.001$).




2016: I was asked to speak at the AAO Scientific Session. My conclusion was that the results are similar for all inter-arch Class II appliances. The differences are probably not clinically significant. We should be focusing on preserving the upper lip and treatment efficiency, including decreasing the treatment time in full edgewise appliances.

2017: Dr. Gianelly's 76% non-extraction target looks right on.

Extraction frequencies at a university orthodontic clinic in the 21st century:
Demographic and diagnostic factors affecting the likelihood of extraction
Tate H. Jackson, Camille Guez, Feng-Chang Lin, William R. Proffit, Ching-Chang Ko

- March 2017
- In a university setting during the first decade of the 21st century, overall orthodontic extraction rates showed a mild decreasing trend, leveling near 25% after 2006



The logo for the American Journal of Orthodontics & Dentofacial Orthopedics (AJO-DO) is located in the bottom right corner of the slide. It features the acronym 'AJO-DO' in a large, bold, blue font, followed by 'AAC' in a smaller blue font with a trademark symbol. Below this, the full name 'American Journal of Orthodontics & Dentofacial Orthopedics' is written in a smaller, red font.

The eye opener:

Prevalence of gingival recession after orthodontic tooth movements

Jason W. Morris, Phillip M. Campbell, Larry P. Tadlock, Jimmy Boley, Peter H. Buschang

American Journal of Orthodontics and Dentofacial Orthopedics, Vol. 151, Issue 5, p851–859, May, 2017

There was no relationship between mandibular incisor proclination during treatment and posttreatment gingival recession. Incisors that finished treatment angulated (IMPA) at 95° or greater did not show significantly more recession than did those that finished less than 95°. There were weak positive correlations ($r = 0.17-0.41$) between maxillary arch width increases during treatment and posttreatment recession.

2019:



Orthodontics Today: Questioning the Current Standards

**ROLF G. BEHRENTS, DDS, MS, PhD,
PhD (Honorary)**

Research Associate: Bolton-Brush
Growth Study Center

Co-Director: G.O.R.P. (Graduate
Orthodontic Residents' Program)

Editor-in Chief: *American Journal of
Orthodontics and Dentofacial Orthopedics*

**STEVEN J. LINDAUER, DMD,
MDentSc**

Editor, *The Angle Orthodontist*
Professor and Chair, Department of
Orthodontics, School of Dentistry, Virginia
Commonwealth University

8:00 – 9:10 AM DR. STEVEN J. LINDAUER

How Orthodontics is Taught and Practiced. So What Do Our Patients Expect?

You will learn if it is appropriate to set goals for orthodontic treatment if there are no confirmed detrimental effects caused by not meeting them; what patients expect and how willing they are to accept compromises.

11:00 – 12:10 AM DR. MARC ACKERMAN

Moving Beyond Faith Based Orthodontics

You will learn the what, why, when and how orthodontics is based on a "fractured fairytale"; where we stand today and where we are going tomorrow.

12:10 – 1:10 PM DR. PETER BUSCHANG

A PhD's View of Evidence Based Orthodontics

You will learn what constitutes "evidence based" in the biological sciences and what evidence exists for the traditional orthodontic standards.

3:40 – 4:50 PM DR. DAVID SARVER

One Clinician's Resolution

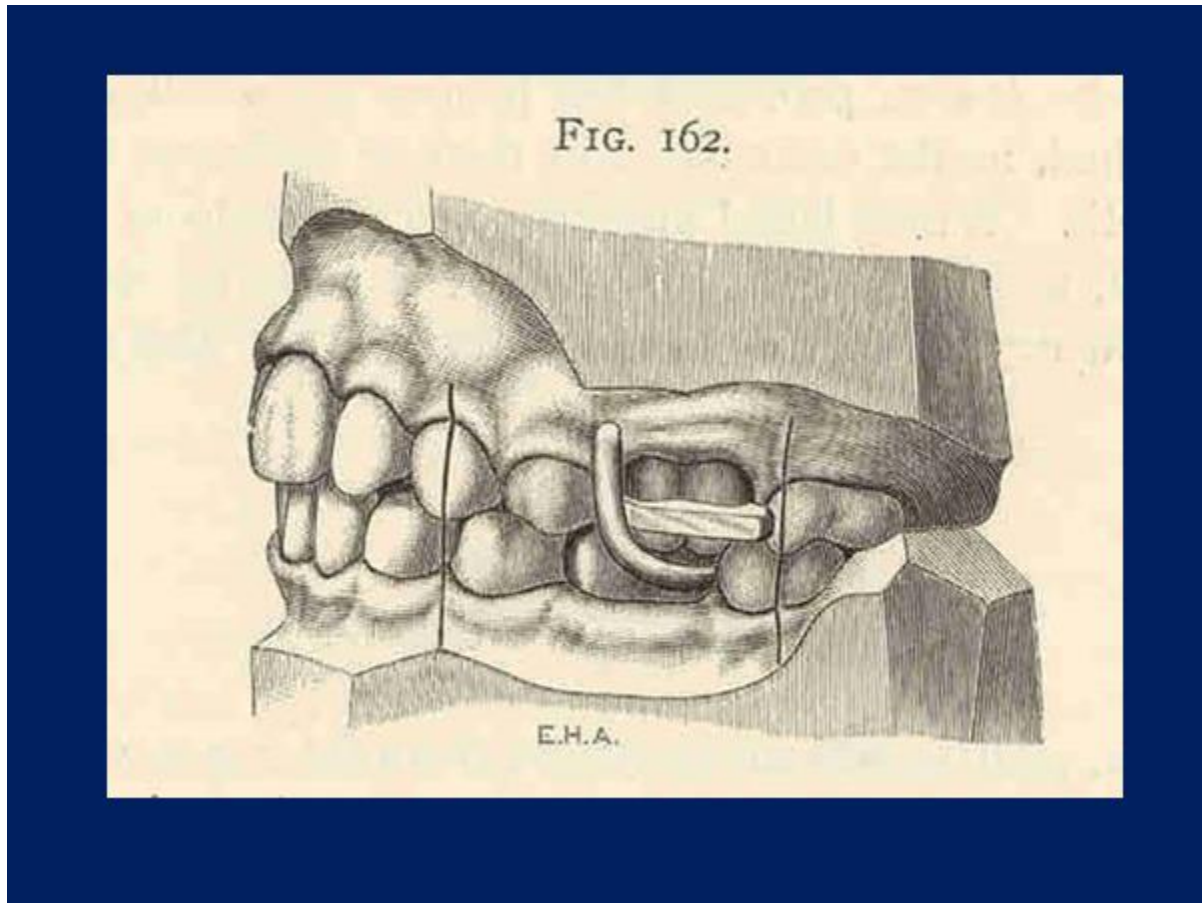
You will learn how a clinician with an emphasis on esthetics blends his treatment objectives with the traditional ABO standards and how conflicts between these standards and esthetic excellence are resolved.

These are some heavy hitters in our profession. Dr. Buschang's research has shown there is little evidence to prove that lower incisor proclination causes gingival

recession. Dr. Behrents told us in 1981 that some recession was normal and that severe recession could be prevented as long as there was attached gingiva present or a graft placed before ortho.

Dr. Lindauer asked me to speak on Crossbow at the AAO in 2016.

Part 3: Ancient History



Dr. Angle's Class II "bite-jumping" appliance, photo courtesy of Dr. Lysle Johnston. This would have resulted in lower incisor proclination. If this caused gingival recession Dr. Angle would have reported it.

History

- 1890, Class II elastics, Angle named it Baker Anchorage after Henry Baker, but Calvin Case claimed first use, started an argument between Angle and Case
- Resulted in the Extraction Debate of 1911, Case criticized Angle's cases for being too protrusive and unstable

History

- 1928, Begg began extracting four bicuspids, used Angle's ribbon arch appliance, round wire, Class II elastics
- 1940, Tweed followed Begg but used the edgewise bracket that he had helped Angle develop, rectangular wire and loops to close spaces, Class II elastics
- 1947, Kloehn, cervical headgear, assisted upper incisor retraction

Dr. Angle's students, Begg and Tweed stopped doing what they had been taught and followed the teachings of Calvin Case. Dr. Tweed was able to control the torque of

the upper incisors as he retracted them to reduce the overjet in Class II's. He was also able to level the Curve of Spee with full size rectangular arch wires and Class II elastics to erupt the lower posterior teeth. When you just looked at the models Tweed was able to make a Class II case look like an ideal Class I skeletal-dental, complete with upright incisors. In 1930 Dr. Broadbent invented the cephalometer which allowed Tweed to measure the inclination of the incisors and compare his results to untreated Class I dental-skeletal patients. This led to the Tweed Triangle and the goal of treating to an upright lower incisor. Tweed was known for saying "Put your plaster on the table", but it was the cephalometric measurements that gave scientific support to the upright lower incisor.

It wasn't until 1956 that Tweed's results were studied closely by Drs. Stoner and Lindquist at Indiana University. Their study "Consecutive Cases Treated by Dr. Charles Tweed" was published in the Angle Orthodontist.

It looked at the claim that Tweed mechanics resulted in improved facial esthetics.

The main finding was that overjet reduction was almost all by upper incisor retraction.

I met Dr. Lindquist while I attended Indiana University. He was the first orthodontist that I heard warn of over-extracting. He said that serial extracting was a "self-fulfilling prophecy" in that extracting primary canines increased the odds that first bicuspid would need to be extracted. He advised to only extract lower primary canines if the lateral incisors were impacted or blocked out.

Dr. Bruce Epker, Maxillo-facial Surgeon

- Modified the BSSO
- 1979, described pre-surgical decompensation
- Extracting in the lower arch in Class II's and in the upper arch in Class III's.
- Proclining lower incisors in Class III's and upper incisors in Class II div 2's.

Dr. Bruce Epker, Maxillo-facial Surgeon

- Treatment plan by placing the upper incisor ideally in the face.
- This may require two jaw surgery.
- At the same time orthodontists were trained to treat to the lower incisor.
- Criticized upper incisor retraction in patients with mandibular retrognathia
- Surgeons were leading the way on aesthetics, not orthodontists.