The Long and Winding Road: How to Regain the Severe Torque Loss in the Insignia™ System

Abstract

***Introduction**: Choosing the correct archwire sequence is essential for achieving optimal outcomes in a timely manner. A digital custom appliance is designed for ideal alignment with the finishing archwire. Translating teeth is problematic when a horizontal force is applied to the arch. Archwires with inadequate stiffness can result in severe loss of incisor torque when anterior segments are retracted. Iatrogenic axial inclination problems increase treatment time and may result in elevated root resorption.*

***Diagnosis**: An 18-year old female presented with a chief complaint (CC) of protrusive lips. Clinical evaluation revealed skeletal protrusion (SNA 88˚, SNB 82˚, ANB 6˚), steep mandibular plane angle (FMA 30˚), bimaxillary lip protrusion (4mm/6mm to the E-line), and a Discrepancy Index (DI) of 26.*

***Treatment**: All four first premolars were extracted, and an Insignia™ system appliance with passive self-ligating brackets was prescribed. Extraction spaces were closed in all four quadrants using titanium molybdenum alloy (TMA) archwires. Bilateral reaction force of ~400cN was anchored with infrazygomatic crest (IZC) bone screws (BSs). The archwire torsional stiffness in the anterior segment was inadequate for the applied load, resulting in decreased axial inclination of maxillary incisors when the anterior segment was retracted. Correction mechanics were: 1. lingual root torque in the anterior segment, 2. anterior nasal spine (ANS) bone screw, and 3. anterior root torquing auxiliary spring.*

***Outcome**: 16mo of space closure resulted in severe distal tipping (31˚) of upper incisors. An additional 12mo of active treatment was required to correct the upper incisal inclination to an optimal 104˚. After 28 months of active treatment, a Cast Radiograph Evaluation (CRE) score of 10 was achieved.*

***Conclusions**: The upper incisal moment to force ratio (M:F) was inadequate for optimal upper incisor retraction. The problem was preventable with: 1. less reaction force (~200cN/side), 2. 20˚ increase in anterior lingual root torque (torsion) on the archwire to increase the moment, and/or 3. a stiffer stainless steel (SS) archwire. The M:F should be carefully evaluated prior to initiating space closure, and incisor axial inclinations should be carefully monitored with progress cephalometrics during space closure. Iatrogenic axial inclination problems (dumping) can usually be corrected with extended treatment time, but prevention is far more efficient and cost effective. (J Digital Orthod 2019;56:26-42)*

Key words:
Insignia™ system, customized passive self-ligating brackets, digital set-up, moment to force ratio, archwire sequence, IZC screw, temporary anchorage devices (TADs), bimaxillary protrusion, extraction of premolars

Introduction

The Insignia™ system allows clinicians to plan with the end in sight.[1-3] A pretreatment digital set-up of the custom fixed appliance optimizes bracket positions and torque levels to achieve an ideal alignment with minimal adjustments. However, achieving the outcome(s) prescribed is more challenging when there are extractions, space closure and retraction of anterior segments. Torque compensations[1,2] are applied to the virtual treatment plan to offset archwire-bracket play and to increase lingual root torque to

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achieve translation rather than "*dumping.*" The goal for translation is to balance the moment to force ratio (*M:F*) to achieve the ***equivalent force system***. The latter is the amount of moment (*torque*) relative to the force that is required to simulate the retraction force passing through the center of resistance (C_{RES}) of the root(*s*). The clinician must prescribe the amount of incisor retraction planned, the allied retraction force, and archwire specifications: material, size and configuration (*pretorqued, expanded or constricted*). The custom appliance is then adjusted to accommodate the planned mechanics. The alternative is to accept the treatment plan proposed by

Fig. 1: Pre-treatment facial and intraoral photographs

Insignia™ because it is compatible with the custom appliance. The amount of tooth movement, archwire specifications and applied retraction force are critical to treatment success.[3] For an optimal outcome in a timely manner, it is critical that the applied mechanics is consistent with the design of the custom appliance.

Etiology and Diagnosis

An 18-year-old female presented with a chief complaint of protrusive lips (*4mm/6mm to the E-line*) (*Figs. 1-4; Table 1*). The lateral cephalometric radiograph was consistent with a skeletal Class II pattern (*SNA 88˚, SNB 82˚, ANB 6˚*). There was a steep mandibular plane (*SN-MP 47˚, FMA 40˚*) and a 3 mm overjet (*Table 2*). The mandibular midline was 0.5 mm to the right. Bimaxillary dental protrusion was consistent with lip protrusion. The upper incisors were labially inclined (*U1 to NA 7 mm, U1 to SN 116.5˚*), as were the mandibular incisors (*L1 to NB 11 mm, L1 to MP 104˚*). The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) score was 26 as shown in the subsequent worksheet.

CEPHALOMETRIC SUMMARY			
DENTAL ANALYSIS			
	PRE-Tx	INTER-Tx	POST-Tx
U1 To NA mm (4 mm)	7 mm	4 mm	0 mm
U1 To SN˚ (104˚)	116.5˚	85.5˚	104˚
L1 To NB mm (4 mm)	12 mm	5 mm	5 mm
L1 To MP˚ (90˚)	104˚	86.5˚	87.5˚

Table 1

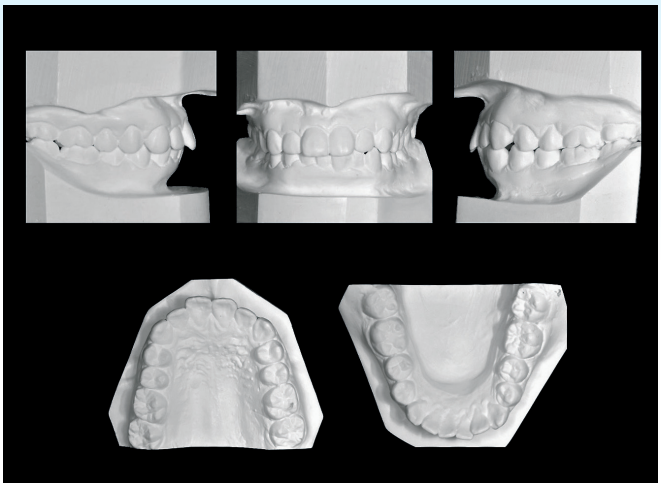

Fig. 2: Pre-treatment dental models (casts)

Fig. 3: Pre-treatment lateral cephalometric radiograph

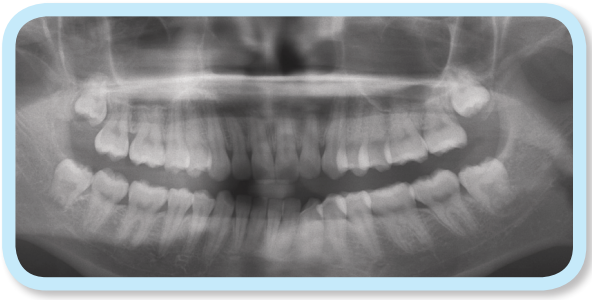

Fig. 4: Pre-treatment panoramic radiograph

Treatment Objectives

1. Retract upper and lower lips.

2. Retract both arches with TAD anchorage and Class II elastics.

3. Establish ideal overjet and overbite.

4. Correct the slight mandibular midline discrepancy.

5. Establish Class I molar and canine relationships.

Treatment Plan

The patient accepted extraction as the optimal approach for reducing lip protrusion. All first four premolars were extracted as indicated by the patient's protrusive profile, steep mandibular plane, and flared incisors.[4] Bilateral infrazygomatic crest (IZC) bone screws were used as anchorage for retraction of both arches.[1]

Digital Set-up

1. Extract upper and lower first premolars.

2. Close extraction spaces with equal and opposite (50-50%) movement of anterior and posterior segments (*Fig. 5*).

3. Incisor Axial Inclination

   3.1 Upper: Decrease 12 degrees

   3.2 Lower: Decrease 14 degrees

Closing extraction spaces tends to decrease the axial inclination of incisors, so 5 degrees of lingual root torque were added to both the upper and lower incisor set-up to compensate for the mechanics. Upper incisor crown torque was reduced from 116.5˚ to 109˚ (*standard 104˚ + over-correction 5˚*). The lower incisor torque was changed from 104˚ to 95˚ (*standard 90˚ + overcorrection 5˚*).

4. Midline correction: Move the midline 0.5 mm to the right (*Fig. 5*)

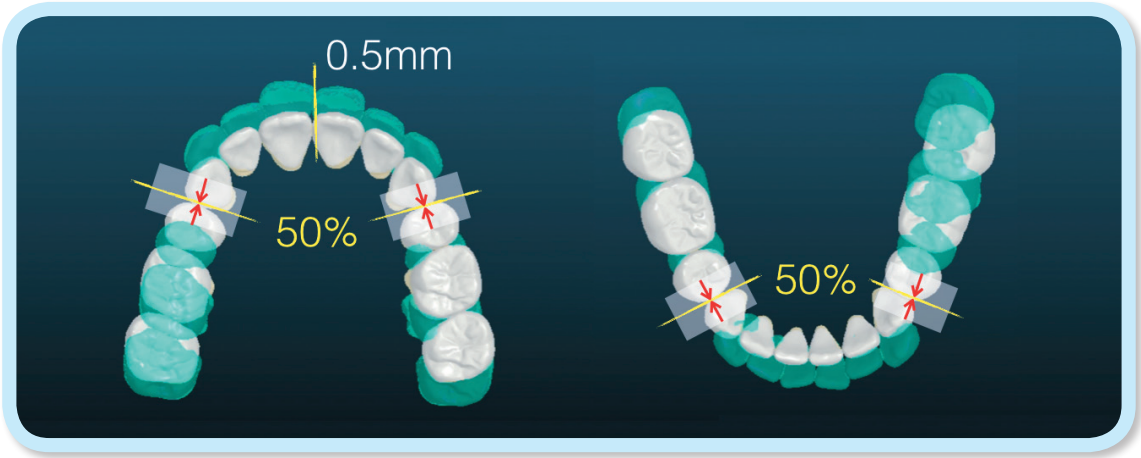

Fig. 5:
Green teeth are the pre-treatment position of the dentition. The planned space closure in both arches is 50% posterior retraction of the anterior segment and 50% mesial protraction of the buccal segments. See text for details.

Treatment Progress

Two months after extraction of the four first premolars, all teeth were bonded with an Insignia™ digitally-designed 0.022-in slot, custom appliance. Extraction spaces were closed with a sequence of two archwires: 0.018x0.025 CuNiTi and 0.019x0.025 TMA. Bilateral infrazygomatic crest (*IZC*) bone screws were installed to serve as anchorage to maximally retract both arches.[5] After five visits over ten months, incisors were retracted (*Fig. 6*) and all spaces were closed using the 0.019x0.025 TMA archwire (*Fig. 7*). However, space closure resulted in the upper incisors being too upright due to a 31˚ torque loss (*U1 to NA 4 mm, U1 to SN*

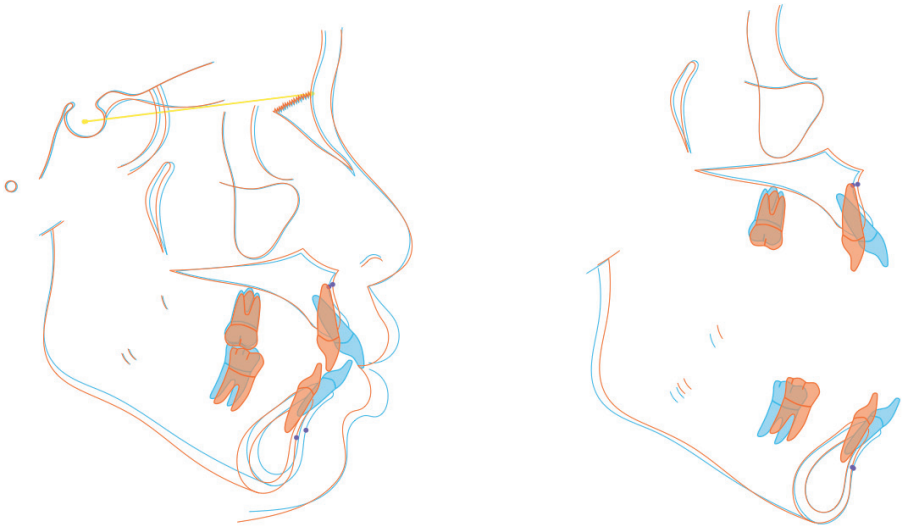

Fig. 6:
Superimposed cephalometric tracings showing dentofacial changes during 14 months of treatment (orange) compared to the pre-treatment position (blue). The upper incisors axial inclination decreased 31˚ to an excessively upright relationship (85.5˚). See text for details.

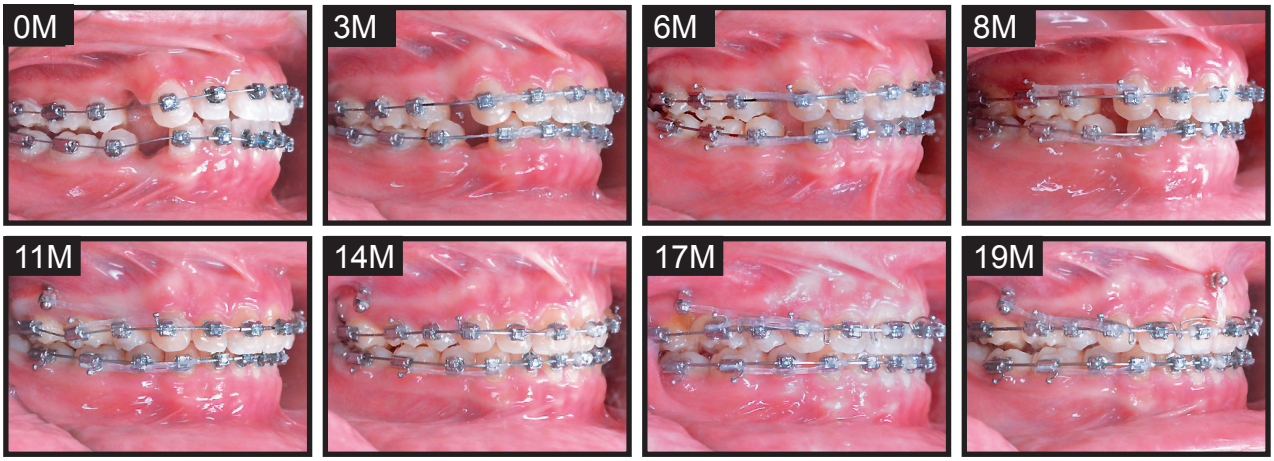

Fig. 7:
A progressive series of right buccal view photographs show treatment progress and the archwire sequence for both arches in months (M) from the beginning of treatment (0M) to nineteen months (19M). The use of TMA wire to close extraction spaces resulted in excessive decrease in the axial inclinations of the upper incisors. At 14M, the upper central incisor crowns are lingually tippied. However, the TMA wire was adjusted in torsion to increase lingual root torque, an anterior nasal spine screw was inserted (19M), and an anterior root torque spring was added (17M) to compensate for the loss of torque.

85.5˚) (*Figs. 6 and 7; Tables 1-3*). Lower incisors were tipped lingually to an acceptable axial inclination (*86.5˚*).

To compensate for the loss of maxillary torque, three adjustments were applied: 1. 15 degrees of lingual root torque, 2. anterior nasal spine (*ANS*) screw to intrude and flare the maxillary incisors, and 3. an anterior torquing auxiliary (*Figs. 7 and 8*). After 12 additional months of treatment, axial inclination of the maxillary incisors was ideal (*U1-SN 104˚*) (*Tables 1, and 4*). The total active treatment time was 28 months. All treatment and sequencing details are shown in Table 3 and Figs. 7-9.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA˚ (82°)	88˚	90˚	2˚
SNB˚ (80°)	82˚	81˚	1˚
ANB˚ (2°)	6˚	9˚	3˚
SN-MP˚ (32°)	37˚	37˚	0˚
FMA˚ (25°)	30˚	30˚	0˚
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	7 mm	4 mm	3 mm
U1 To SN˚ (104°)	116.5˚	85.5˚	31˚
L1 To NB mm (4 mm)	12 mm	5 mm	7 mm
L1 To MP˚ (90°)	104˚	86.5˚	17.5˚
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	4 mm	1 mm	3 mm
E-LINE LL (0 mm)	6 mm	1 mm	5 mm
%FH: Na-ANS-Gn (53%)	55%	57%	2%
Convexity: G-Sn-Pg' (13°)	16˚	16˚	0˚

■ *Table 2: Cephalometric summary after 14 months of treatment. Note the extreme torque loss, especially in the upper incisors.*

Treatment Results

At the end of active treatment, the patient was treated to the desired result. Overjet was corrected from 3 to 0 mm (*Figs. 10 and 11*), extraction spaces were successfully closed (*Fig. 12*), and axial inclination for incisors was near ideal (*U1-SN 104˚, L1 to MP 86.5˚*) (*Figs. 12 and 13; Tables 1 and 4*). Anchorage loss was minimal because the treatment plan was changed to use IZC BS anchorage to achieve 90% anterior retraction.[5] The lips were retracted 3mm/5mm. The ABO Cast Radiograph Evaluation (*CRE*) score was 10 points (*shown in the subsequent worksheet*), which is an excellent outcome for malocclusion with a DI score of 26. The Pink and White Esthetic Score was 2.

Discussion

1. Archwire Sequence

Although a favorable outcome was achieved in 28 months (*Fig. 14*), treatment duration was extended 12 months to correct iatrogenic problems of decreased axial inclinations of the upper incisors (*dumping*) that was associated with anterior segment retraction. The proximal cause of the incisal dumping (*Fig. 6*) was an inadequate M:F delivered by the 0.018x0.025-in TMA archwire. In analyzing the etiology of the problem, it is important to consider two confounding variables associated with the decision to use of IZC BS anchorage: 1. large maxillary retraction force of ~400cN per side decreased the M:F producing excessive tipping, and 2. anterior segment retraction was 90% of the extraction space rather than the 50% planned (*Fig. 5*), which increased the tendency for incisor tipping. When the decision was made to use

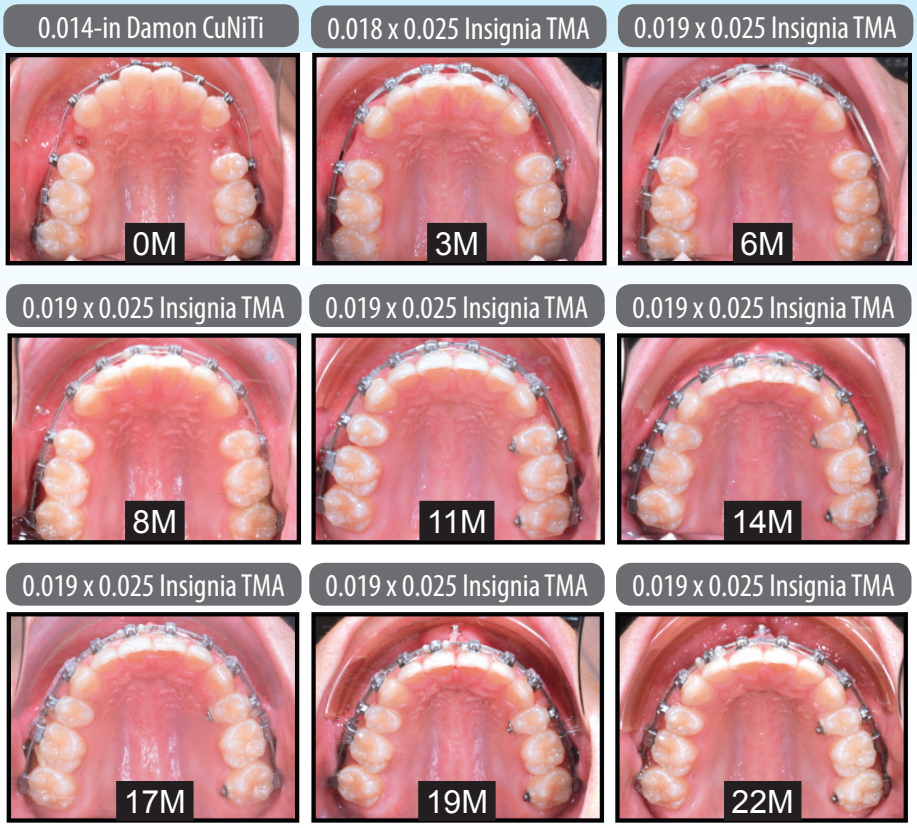

Fig. 8: A series of upper occlusal views show progress from the start of treatment at zero month (0M) to twenty-two months (22M).

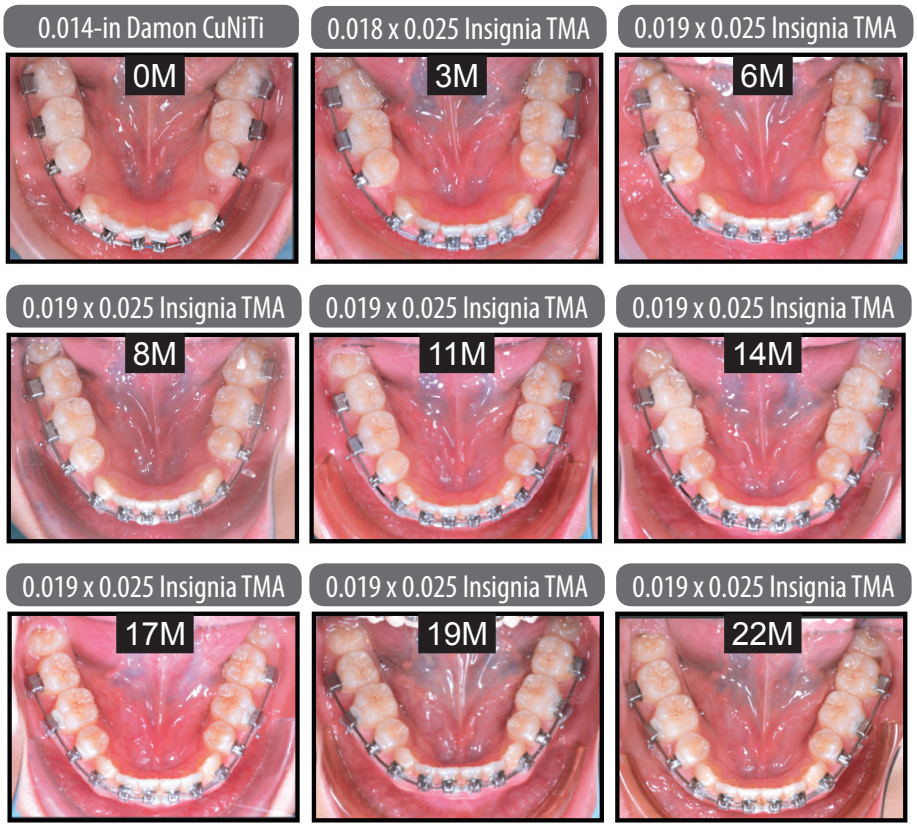

Fig. 9: A series of lower occlusal views show progress from the start of treatment at zero month (0M) to twenty-two months (22M).

TAD anchorage, it was appropriate to reduce the force by 50% to ~200cN/side if the TMA archwire was retrained, or switch to a stiffer archwire such as SS to express a larger moment as the incisors are retracted.

It is challenging to determine the M:F ratio when a space closure appliance is activated. An experienced clinician can estimate the moment applied to the anterior segment by fitting the archwire in the anterior brackets and then sensing or measuring the force required to move the buccal segment of the archwire to the level of the posterior brackets. However, the actual clinical performance of the mechanism is best assessed with a progress cephalometric radiograph during space closure. The tooth movement response is usually apparent within a month or two during space closure. Orthodontists routinely use progress panoramic radiographs to correct bracket positions, but few regularly employ cephalometrics to monitor progress in correcting lip protrusion and axial inclination of incisors. Errors in the sagittal plane (*e.g. lip protrusion, incisor axial inclinations, posterior rotation of the mandible*) are far more serious problems than incorrect bracket orientation in the buccal segments. Second order problems due to incorrect bracket positions can be corrected in a month or two, but a 10˚ error in the

Fig. 10: Post-treatment facial and intraoral photographs

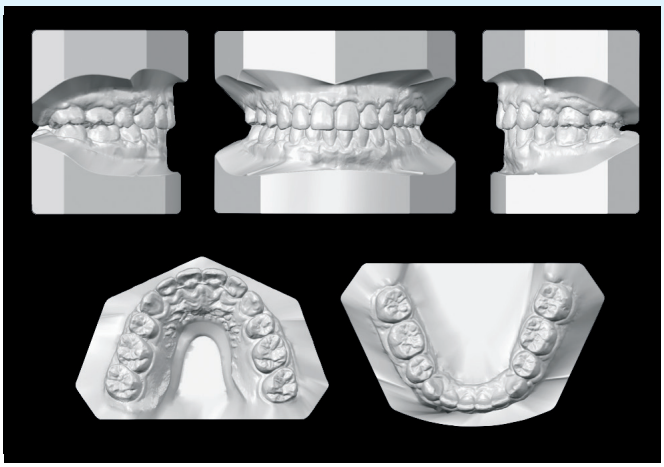

Fig. 11: Post-treatment dental models (casts)

Fig. 12: Post-treatment lateral cephalometric radiograph

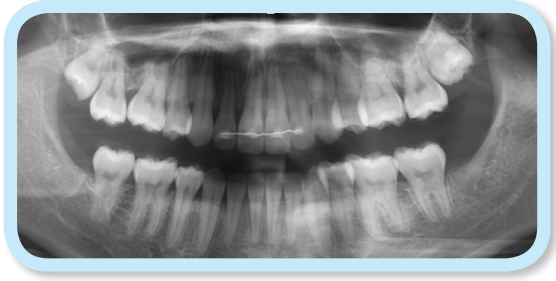

Fig. 13: Post-treatment panoramic radiograph

sagittal axial inclination of incisors required 12mo of additional treatment (*Figs. 6 and 7*). Early correction of space closure biomechanics is much more efficient than correcting severe incisal dumping or bite opening after the spaces are closed.

In addition to inadequate torque, the TMA archwire bowed in a clockwise direction which extruded the maxillary incisors and tip them lingually (*Fig. 7*).[6] TMA was an exceedingly flexible material (*Fig. 15*) for the high retraction force and large distance of retraction.[7] To avoid the 31˚ upper incisor torque loss, it would be wise to use a 0.019x0.025 SS archwire because it is over twice as stiff as a TMA wire of the same size (*Fig. 15*).[8] Although a 0.019x0.025-in SS wire has 11˚ of play, once engaged, the material is more ideal for major mechanics like space closure because of its rigidity.[9] The integrity of the arch can be maintained during space closure with chains of elastics,[10] but the retraction force must be carefully paired with an appropriate root lingual moment (*Fig. 7*). After extraction spaces are closed, torque expression and final detailing can be achieved using a 0.021x0.025 TMA archwire.

In general the wire sequence (*Table 3*) should be as follows: 0.014 CuNiTi, 0.014x0.025 CuNiTi, 0.018x0.025 CuNiTi, and 0.016x0.025 SS.[3,10] If large extraction spaces are closed, the wire sequence should include an additional wire, 0.021x0.025 CuNiTi, before switching to stainless steel, preferably 0.019x0.025 SS (*Table 5*), to begin space closure. The full-sized CuNiTi arch wire is used to prepare for the insertion of the SS wire.[3,10] At the end of treatment, either the 0.021x0.025 CuNiTi or 0.021x0.025 TMA wire can be used to achieve finishing details.[3,10,11]

Appointment	Archwire	Notes
1 (0 months)	U/L: 0.014-in Damon CuNiTi	Bond InsigniaTM digitally-designed 0.022-in custom appliance upper and lower from 7-7
2 (1 months)	U/L: 0.014x0.025-in Insignia CuNiTi	
3 (3 months)	U/L: 0.018x0.025-in Insignia CuNiTi	Power chains
4 (6 months)	U/L: 0.019x0.025-in Insignia TMA	Fox (1/4-in, 3.5-oz) from U3s to L5-6s Close the spaces
5-8 (7-9 months)		Power chains Fox (1/4-in, 3.5-oz) from U6-7s to Button UR7 and UR5
9 (10 months)	U/L: 0.018x0.025-in Insignia CuNiTi	IZC bone screws buccal to UR6 and UL6
10 (10 months)	L: 0.014 x 0.025 Insignia CuNiTi	
11 (11 months)	U: 0.019 x 0.025 Insignia TMA L: 0.018 x 0.025 Insignia CuNiTi	
12 (13 months)	L:0.019x0.025-in Insignia TMA	Power chains
13-15 (14-16 months)		AA UL2 -10, UR2 +10, L2s Power chains
16-18 (18-20 months)	U/L: 0.021x0.025-in Insignia TMA	IZC bone screw between UR1 and UL1 Power chains Anterior root torque added
19-20 (21-23 months)		Remove anterior root torque Twisted wire +15 degrees Power chains, power tubes, expand upper archwire
21 (24 months)	U: 0.021 x 0.025 Insignia TMA	Expand upper archwire Debond IZC bone screws UR6 and UL6
22-23 (25-27 months)		Finish detailing

■ *Table 3: Treatment sequence*

2. Correcting Incisal Torque

Preventing the problem by detecting it early with cephalometrics is preferred, but if the incisal torque loss is not discovered until after space closure, there are several methods for correction: 1. adjust 15˚-20˚ of lingual root torque into the anterior segment of the 0.018x0.025-in TMA archwire, 2. place a 20˚ pretorqued 0.019x0.025-in CuNiTi archwire, 3. insert an anterior nasal spine (*ANS*) screw between the two incisors (*Fig. 16*), and 4. fit an anterior root torquing spring to deliver lingual root torque to the maxillary anterior teeth (*Fig. 17*).[12] All of these methods result in lingual root torque on the maxillary incisors. They can be used in a

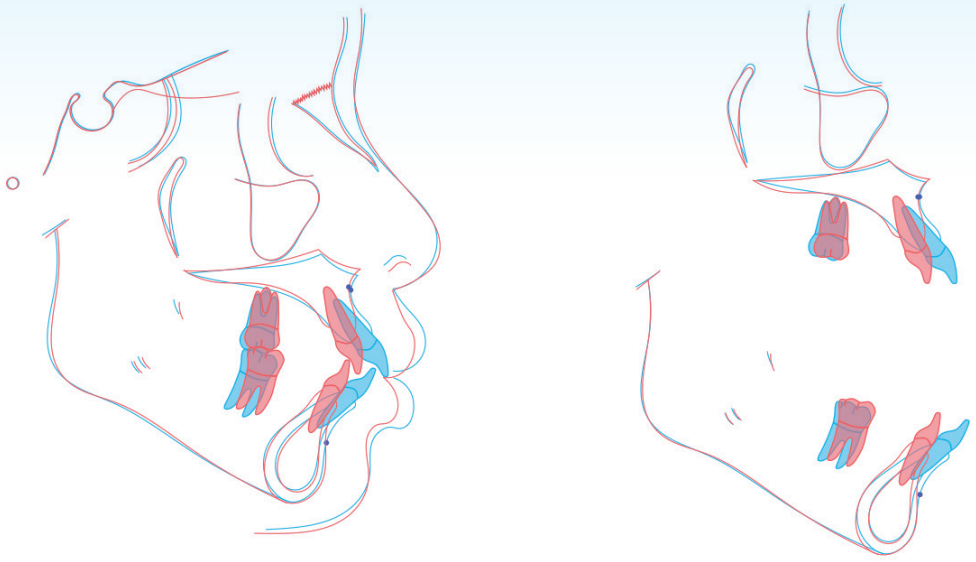

Fig. 14:

Superimposed cephalometric tracings showing dentofacial changes over 28 months of treatment (red) compared to the pre-treatment position (blue). Note that these tracings involve roundtrip movement of the maxillary incisors. See text for details.

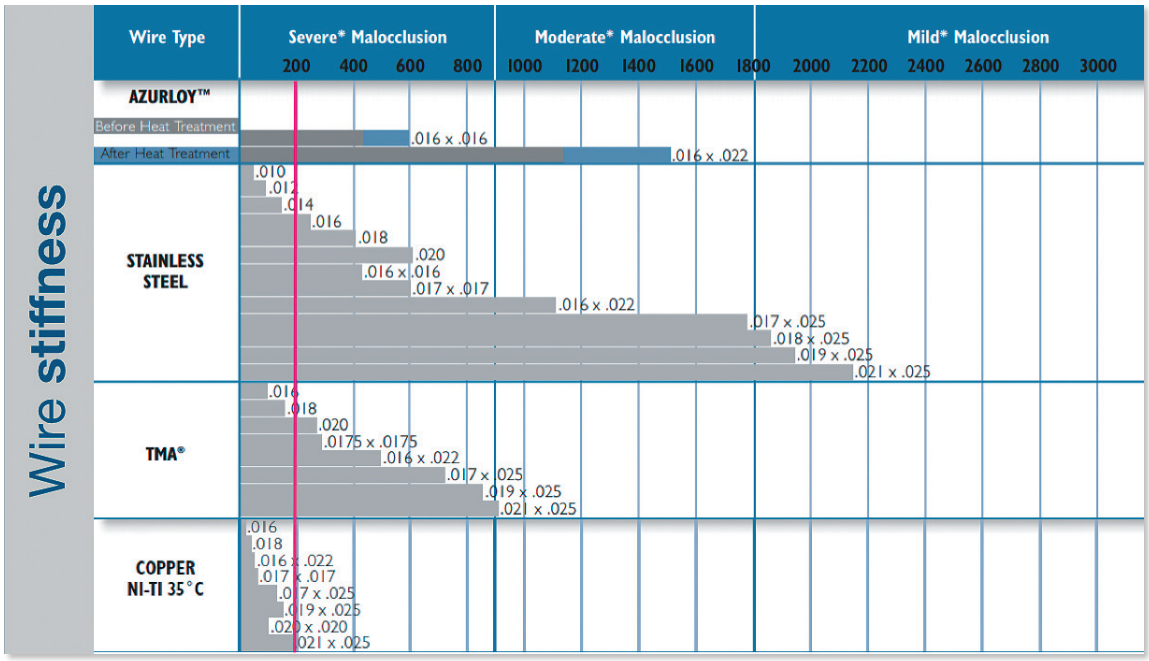

Fig. 15:

Wire stiffness is directly related to the modulus of elasticity (CuNiTi < TMA < SS) and the cross-sectional area of a wire. For a given cross-section TMA is about 5X stiffer than CuNiTi 35 °C, and SS is over twice as stiff as TMA. See text for details.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	88°	88°	0°
SNB° (80°)	82°	82°	0°
ANB° (2°)	6°	6°	0°
SN-MP° (32°)	37°	37°	0°
FMA° (25°)	30°	30°	0°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	7 mm	0 mm	7 mm
U1 To SN° (104°)	116.5°	104°	12.5°
L1 To NB mm (4 mm)	12 mm	5 mm	7 mm
L1 To MP° (90°)	104°	87.5°	19.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	4 mm	1 mm	3 mm
E-LINE LL (0 mm)	6 mm	2 mm	4 mm
%FH: Na-ANS-Gn (53%)	55%	57%	2%
Convexity: G-Sn-Pg' (13°)	16°	14°	2°

Table 4: Cephalometric summary

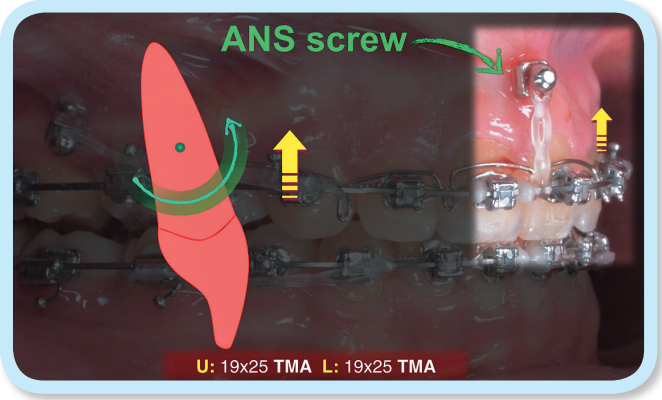

Fig. 16:
An anterior nasal spine (ANS, green arrow) bone screw is inserted between the two maxillary central incisors. The upper and lower archwires are 0.019x0.025-in TMA. Since the power-chain anchored by the ANS screw has a line of force labial to the center of resistance, the force applied to the archwire (yellow arrows) results in a moment of the force (green circular arrow) around the center of rotation (green dot) of the incisor, which produces lingual root torque. See text for details.

sequence or in combination to increase the axial inclination ~15° to return to an ideal angle of 104° for upper central incisors (*Fig. 18*). When using the ANS TAD, the line of force for the power chain is labial to the center of resistance for the incisor roots so it produces lingual root torque and intrudes the incisors simultaneously (*Fig. 16*).

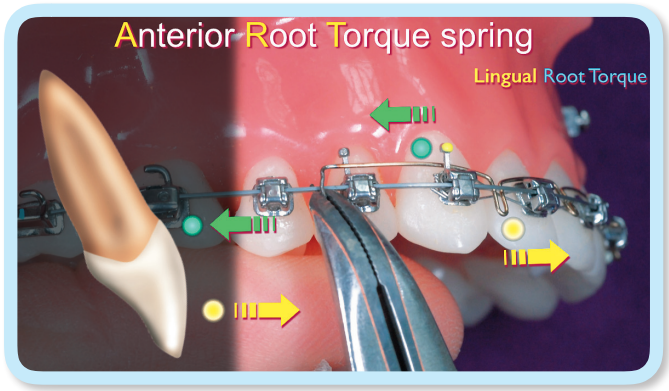

Fig. 17:
When the hooks on the Anterior Root Torque spring are engaged occlusal to the base archwire as shown with Weingart pliers, the spring applies an intrusive force and a couple (opposing green and yellow arrows) to each incisor (left). This mechanism applies lingual root torque to the maxillary incisors. See text for details.

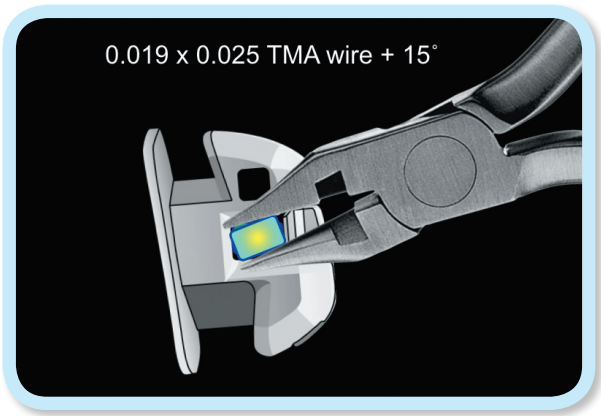

Fig. 18:
A 15° torsional bent in the anterior segment of a TMA wire (green) results in lingual root torque on the tooth when the archwire is twisted and inserted into the bracket with the pliers as shown. See text for details.

Wire Sequence	
Non Extraction	Extraction
1. 0.014 CuNiTi	1. 0.014 CuNiti
2. 0.014 x 0.025 CuNiTi	2. 0.014 x 0.025 CuNiTi
3. 0.018 x 0.025 CuNiTi	3. 0.018 x 0.025 CuNiTi
4. 0.026 x 0.025 SS	4. 0.021 x 0.025 CuNiTi
	5. 0.019 x 0.25 SS

Table 5: Recommended wire sequence for extraction and non extraction cases.

3. Biomechanics

The torque settings for an Insignia™ treatment plan are predicated on the amount of space closure force and the distance the anterior segment will be retracted. To utilize the appropriate retraction force, the clinician must carefully evaluate the M:F when initiating space closure. IZC BSs typically anchor about 14oz (*397g or 389cN*) of elastomer force bilaterally.[7] Assume a curved archwire with a total retraction load of almost 800cN delivers ~400cN of retraction force to each incisor, and the C_{RES} is ~10mm apical to the bracket for each tooth. To translate the incisor roots distally, the archwire must deliver a uniform moment of 4000cN-mm to each to each incisor. This is more than twice the torsional range for a flat (*no activation*) 0.018 x 0.025-in TMA archwire.[13] The moment applied during incisal retraction can be increased by adding torque to the Insignia™ prescription and utilizing a 20° pretorqued TMA archwire. However, that adjustment may be inadequate because the moment required for translation is beyond the torsional range for TMA.[13] A total maxillary retraction force of almost 800cN requires a stiffer material like SS to provide an adequate root lingual moment. Consistent with its higher modulus of elasticity, SS delivers more than twice the moment in torsion compared to a TMA wire of identical dimensions.[13]

Conclusions

1. SS wires are stiff in both bending and torsion, which are the archwire properties required to retract anterior segments during posterior space closure.

2. TMA wire is preferable for finishing bends because it is easy to adjust and applies less force to the teeth.

3. Correcting a severe sagittal torque loss is facilitated by combinations of mechanics to apply lingual root torque to upper incisors.

4. Prevention is the best policy because correction of a severe axial inclination problem requires a much longer treatment time.

5. A clinician must understand the mechanical properties of materials when designing mechanics for all fixed appliances.

Acknowledgments

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 30

OVERJET

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

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

Total = 2

OVERBITE

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

Total = 0

ANTERIOR OPEN BITE

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

Total = 0

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total = 0

CROWDING (only one arch)

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

Total = 1

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side _____ pts.
Full Class II or III	=	4 pts. per side _____ pts.
Beyond Class II or III	=	1 pt. per mm. additional _____ pts.

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° _____ x 1 pt. = _____

Each degree > 6° _____ x 1 pt. = _____

SN-MP

≥ 38° = 2 pts.

Each degree > 38° 9 x 2 pts. = 18

≤ 26° = 1 pt.

Each degree < 26° _____ x 1 pt. = _____

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 2 x 1 pt. = 2

Total = 27

OTHER (See Instructions)

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

Identify:

Total =

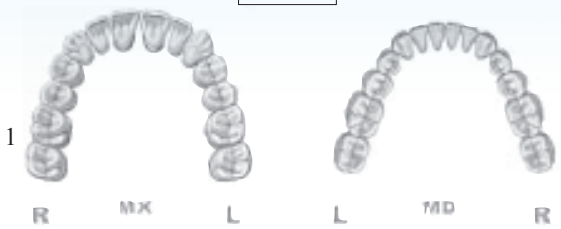
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 10

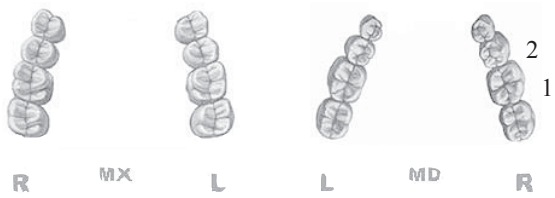
Alignment/Rotations

1



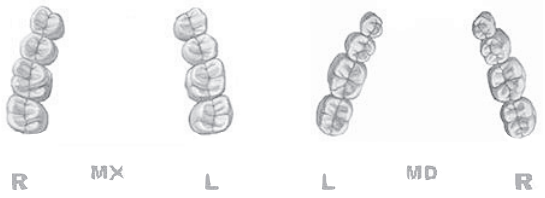
Marginal Ridges

3



Buccolingual Inclination

0

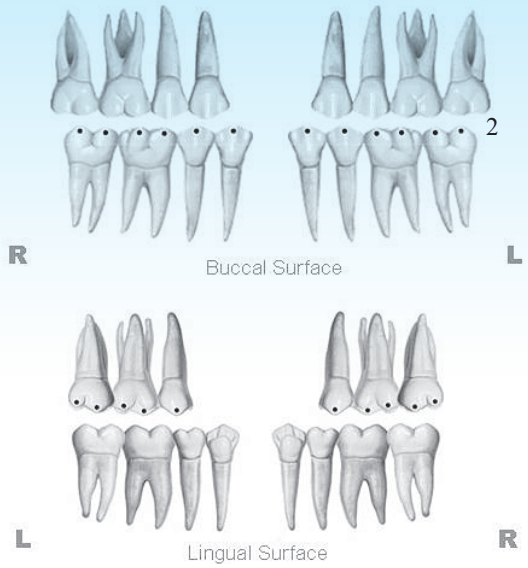


Overjet

0

Occlusal Contacts

2

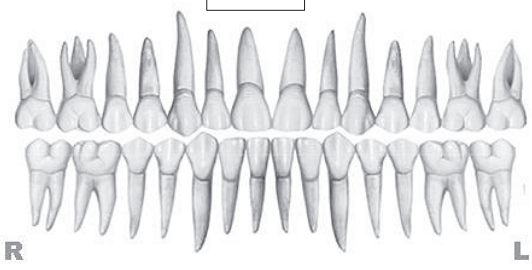


Occlusal Relationships

4

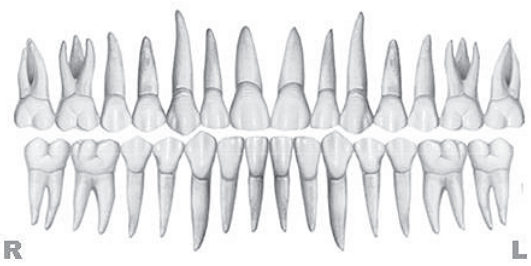
Interproximal Contacts

0



Root Angulation

0



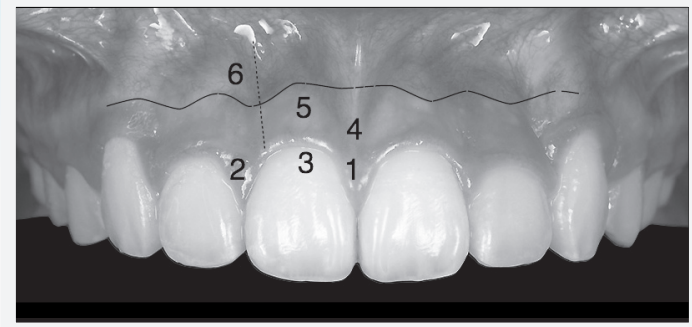
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 2

1. Pink Esthetic Score

Total = 1

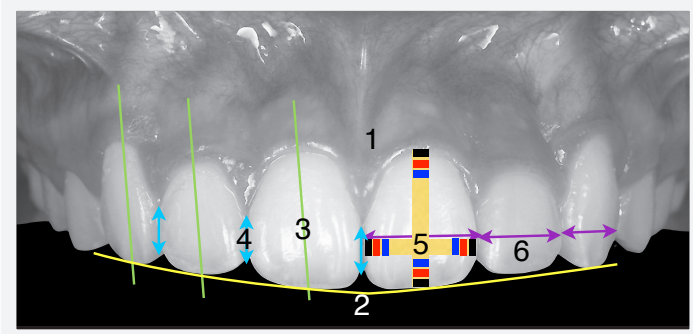


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

1. M & D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	0	(1)	2
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

2. White Esthetic Score (for Micro-esthetics)

Total = 1



1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2

1. Midline	(0)	1	2
2. Incisor Curve	(0)	1	2
3. Axial Inclination (5°, 8°, 10°)	0	(1)	2
4. Contact Area (50%, 40%, 30%)	(0)	1	2
5. Tooth Proportion (1:0.8)	(0)	1	2
6. Tooth to Tooth Proportion	(0)	1	2