THE TWEED PROFILE

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Paraphrasing Socrates, “It is more important to be reminded of OLD TRUTHS than to be introduced to NEW THEORIES”.

There will be little if any new information in this presentation, but I hope that the references from the literature, studies, and case reports will strengthen your convictions.

Remember “Faces First” is our battle cry! (Fig. 1) We take pride in being able to give our patient life altering profile changes and produce beautiful smiles. (Fig. 2)

Esthetics is the NUMBER ONE motivator of our patients and we should provide it. But, as a member of the HEALTH professions, we should strive to achieve all four of Dr. Tweed’s classic goals: esthetics, health, function, and stability. These goals are precisely what the Tweed Merrifield philosophy, diagnosis, and treatment accomplishes.
This lady (Fig. 3, 4 and 5) is an example of fulfilling all four goals. She is now 40 years old, 24 years post treatment, and 20 years postretention. She has a nice profile and smile, good occlusions, healthy periodontum, and stability.

Dr. Tweed brought us into the modern era when he related facial esthetics to the underlying dentition. He found that for patients who have normal skeletal patterns, the mandibular incisor should be upright over basal bone (90° + 1.5°) for best facial esthetics and stability. With the advent of the cephalometer Dr. Tweed developed the diagnostic triangle. He stated that “The diagnostic triangle is my greatest contribution to orthodontic”. He noted that the triangle is a guide that should be used in conjunction with your brain and that there are exceptions to its use.

Many other norms and analyses were proposed by Downs, Reidel, Rickets, Williams, Wylie, Margolis and Steiner to name a few. A common objective of their studies was to evaluate the skeletal pattern and the protrusiveness of the dentition. The findings of these men were quite similar to those of Tweed.

The concept that a normal face is dependent on a normal skeletal pattern and normal relation of the teeth to their bases is self evident, i.e. it is unlikely that a normal face will be found on a high angle Class II skeletal pattern or in a patient with a large bialveolar protrusion.

If we are to have the goal of a good face, we need to define a good face.
- A good face equals good soft tissue and a good smile.
- Good soft tissue equals “balance and harmony of facial lines”. i.e.: good profile, lips lightly touching with no strain, strong chin and nice lip curl.
- A good profile fits one or more of these norms: E-line of a 12 to 14 year old = -2 ±3mm; H-line = 5 ±2mm; Z angle = 70° to 80°.

I will be using the E-line in this paper because the majority of the literature I will be referencing used the E-line in the studies.

Numerous investigators have found similar norms for E-line. For young adults, Rickets ’68 -4 ±3mm, McNamara ’93 -3.58mm, Nanda ’95 -3.13mm, Huang ’00 -4.2mm, Bishara ’85 males -4.0 ±2mm & females -2.0 ±2mm.

Some might say, “The normal face has the lips behind E-line a varying amount, depending upon age, but what do people prefer?”

Preferences have also been studied. Czarnecki, Nanda and Currier found that 545 professionals who were surveyed favored the female profile that was “straight”, with a strong chin and lips behind E-line. The least favored female profile had more protrusive lips that were on or ahead of E-line, along with a weaker chin. (Fig. 6) The male profile most preferred and least preferred were similar to the female preferences. (Fig. 7)
Foster surveyed the preference of professionals and laypeople. He found that both groups preferred the lips behind the E-line from eight years to adulthood. Preference of straighter profiles increased with age. (Fig. 8)

Nomuro studied the preferences of laypersons from various ethnic groups for the Caucasian profile. “All judges preferred the lips posterior to the E-line” (-2.13mm to -3.45mm ±2mm).

America has voted with its dollars. The lips are posterior to the E-line in the vast vast majority of the Caucasian movie stars and models. (Fig. 9 & 10) They also have no mentolis strain and strong chins. (Fig. 11 & 12) Full voluptuous
lips are fine but, they should not be protrusive. (Fig. 13 & 14)

Stability was a major problem for our early pioneers. Angle, Kingsley and Hawley have been quoted as bemoaning the problem of stability. Remember, they were all adhering to a philosophy of a full complement of teeth. Tweed was experiencing the same problem with stability. Those problems along with protrusive faces prompted the historic study of his failures. Tweed was instrumental in starting the specialty down the path of minimal expansion and cephalometric guidelines. Other early pioneers who did stability studies were Nance and Strang. The major conclusions from these three early icons were: Do not flair mandibular incisors; do not expand the mandibular arch; do not increase the mandibular arch length in the mixed dentition. One of Nance’s memorable statements, “The orthodontist is given a limited amount of basal bone… he should not seek to enlarge that area…efforts to do so will be rewarded only with failure”, is the precursor to our “Limit of the Dentition”. These early pioneers’ admonitions have been supported by the more recent literature and experience.

The subsequent constriction of the mandibular canines after expansion is probably the most documented phenomenon in orthodontics. Burke’s meta-analysis, published in the Angle Orthodontist, expresses the “final answer”. “Mandibular intercanine width contracts post-retention to approximately the original dimension”.

The frequent rebound posttreatment of displaced mandibular incisors has also been well documented. Felton, De La Cruz and Kahl-Nieke. All found that expanded mandibular arches tend to return toward their original form.

There are numerous studies which have found that arch length decreases from the mixed dentition to adulthood. So, if there is not enough arch length to accommodate the permanent teeth in the mixed dentition, there will be even less in the adult dentition. Why on earth would anybody try to squeeze all of the teeth into a shrinking arch?

I did a review of the 1980-2005 literature that reported on the long term stability of the mandibular incisors. Thirty-five studies were included. Seventy (70%) of the samples and subsamples found a minimal Little’s irregularity index (<3.5mm) at recall with an average of 12 years post-treatment. The average irregularity index for these studies, both extraction and non-extraction samples, was 3mm. This value is well below Little’s arbitrary 3.5mm value that he contends was satisfactory.
There were three common characteristics in these stability studies. These were: minimal expansion of mandibular canines and molars; uprighting and retracting, or at least minimal flaring, of the mandibular incisor; decreased or minimal increase in mandibular arch perimeter or AP arch length. These common characteristics seem to be considered prerequisites for stability. Also, numerous studies have found that expansion anteriorly and/or laterally can be detrimental to the periodontium, another good reason to minimize the expansion of the mandibular arch.

Since the width and anterior limit of the mandibular arch is constrained by both health and stability concerns, and the upper arch has to fit the lower arch, the width of the smile is “pre-determined”. There is no doubt that there are exceptions to all rules, but these basic concepts apply the vast majority of the time.

If one studies and believes the literature, there should no longer be an extraction/non-extraction debate! Extractions do not equal bad faces! Listed below are some references:

- Drobocky and Smith, AJO 1989; Young and Smith AJO 1993; Paquette et al., AJO 1993; McLaughlin and Bennett, AO 1995; Johnson and Smith, AJO 1995; James, AAO 1998; Bowman and Johnston, AJO 1999; Boley, AJO 1998; Bowman and Johnston, AO 2000; and Boley, Seminars in Orthodontics 2001.

But some may ask, “Does the extraction face age more rapidly”? The answer is “NO”! Here are a few references: Zierhurt et al., AJO/DO 2000; Paquette et al., AJO/DO 1992; Luppanapornlarp and Johnston, AJO/DO 1993; Franklin Thesis, University of Toronto, 1995; Mentz Thesis, University of Toronto, 1996; and Stephens, AJO/DO 2005.

What about those dark buccal corridors? The literature is mixed on this subject. Studies that have found large corridors less attractive are: Moore and Casko, AJO/DO 2005; Matin, EurJO 2007. Conversely, studies that reported that the size of the corridor makes no difference are: Johnson and Smith, AJO/DO 1999; Roden-Johnson et al., AJO/DO 2005; Ritter, AJO/DO 2006. (Fig. 15 & 16) Buccal corridors may not be a major factor, but it seems intuitive to avoid excessively large ones and to make the smile as broad as possible without sacrificing health and stability.

The size of the buccal corridors should not even be a part of the extraction/non-extraction debate. Kim and Gianelly, AJO/DO 2003, found that the maxillary arch was slightly wider when measured at a constant depth in an extraction sample and that the smile esthetics were the same for both the extraction and nonextraction samples. Johnson and Smith, AJO/DO Aug 1995, also found “…no significant difference in the mean esthetics score (of the smile) of extraction and nonextraction patients”.

Fig. 15

Fig. 16

Fig. 17
There are plenty of movie stars and “Miss Everythings” who have been treated with extractions. (Fig. 17 & 18) Extracting premolars didn’t ruin the smiles of these beautiful ladies.

More than minor flaring of the anterior teeth frequently results in lips that are anterior to E-line, mentalis strain and a weak chin — in addition to putting the patient much more at risk for periodontal problems and relapse. Any good observer will admit that we are seeing much more of this today.

To quote Ron Roth in his Heritage Lecture 2002, “Today we are seeing people who are throwing out all of the goals to keep all of the teeth”. I think Ron was RIGHT ON!

In summary, the point of this lecture is: good facial esthetics, health, function and stability are inter-related and achievable in the vast majority of patients! This presentation will conclude with a couple of my case studies in the long term stability samples I have collected.

**Case #1** (Fig. 19-26)

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**Fig. 19: Pretreatment Facial Photographs**
Age: 12yr 2mo - 1972

**Fig. 20: Pretreatment Dental Casts: Class II Div 1**

**Fig. 21: Pretreatment Cephalometric Tracing**

**Fig. 22: Posttreatment Facial Photographs**
Age: 15yr 10mo

**Fig. 23: Posttreatment Dental Casts**
Fig. 24: Posttreatment Cephalometric Tracing

Fig. 25: Postretention Facial Photographs
Sept. 2006 31 yrs PT Age: 46 yr 9 mo

Fig. 26: Intra Orals 28 yr 1 mo Post-Retention

Fig. 27: Pretreatment Facial Photographs
Age: 14 yr 6 mo - Feb. 1966

Fig. 28: Pretreatment Dental Casts

Fig. 29: Pretreatment Cephalometric Tracing

Case #2 (Fig. 27-35)
Fig. 30: Posttreatment Facial Photographs
Age: 16yr 7mo - July 1968

Fig. 31: Posttreatment Dental Casts

Fig. 32: Posttreatment Cephalometric Tracing

Fig. 33: Cast Comparisons 1966 & 2008
38 yrs. 5mos Post Retention

Fig. 34: Postretention Facial Photographs

Fig. 35: Postretention Intra Oral Photographs
AN ANALYSIS OF HORIZONTAL MANDIBULAR GROWTH AND RESPONSE

George Harris
Menominee, Michigan

This paper describes a simple vector analysis of mandibular growth and response that has been developed and used over the past 30 years in my office.

METHOD
To use this analysis, secure two cephalograms of the same patient which were taken at least one year apart. Trace the cephalograms carefully. Locate the most distal point of the lingual curvature of the mandibular symphysis on the original tracing. This landmark is called W point (Fig. 1). (It is named for H. Peter Witsky who did a thesis on the subject.) The second tracing is now placed over the tracing of the first cephalogram and superimposed on the lingual curve of the mandibular symphysis. The mark (W) on the original tracing is transferred to the second tracing. It is called W’ on the second tracing (Fig. 2).

The two tracings are then superimposed with the conventional cranial base superimposition method. The Sella-Nasion line is used with registration at Sella. The two points, W and W’, are now separated. To ascertain horizontal mandibular response, draw a line that is perpendicular to the original occlusal plane from each W point. The distance in millimeters between the two points, W and W’, on the original occlusal plane, is termed Horizontal Mandibular Response (Fig. 3) because the term suggests that the horizontal translation of the mandible relative to the pretreatment occlusal plane is influenced both by mandibular growth and orthodontic treatment.

DISCUSSION
Orthodontists attempt to favorably modify the direction of the child’s growth potential. It can be modified unfavorably if the vertical dimension is increased and the occlusal plane is rotated in a clockwise direction. If this happens, a patient might have a negative horizontal mandibular response. In this scenario the mandible will rotate down and back.

A careful monitoring of the mandibular response during treatment will give the clinician guidelines as to whether or not the forces and the original treatment plan are working for each individual patient. The records of the following patient illustrate the concept of...
changes that can be made in the face and the dentition if the horizontal mandibular response is favorable during treatment.

CASE REPORT
The patient is a 13 year old boy who has no significant medical history. The photographs of the face (Fig. 4) exhibit a reasonably good facial profile. The mandible has a slight retrognathic tendency. The casts (Fig. 5) exhibit a deep overbite with an Angle’s Class II relationship on the right side. The curve of Spee is deep. There is minimal mandibular anterior crowding. The pretreatment panoramic radiograph (Fig. 6) confirms that all teeth are present with no pathology. The pretreatment cephalogram and its tracing (Fig. 7) confirm a skeletal retrognathia with an ANB of 6° and an SNB of 75°. The Z angle is 74°.

TREATMENT PLAN
Due to the lack of mandibular anterior or midarch crowding, the relatively low mandibular plane angle, and the Z angle of 74°, the patient was started without the removal of premolars. The treatment plan was to start the patient and prepare mandibular anchorage after the removal of the mandibular third molars.

POSTTREATMENT
The posttreatment facial photographs (Fig. 8) exhibit a very pleasing face – one that exhibits no mandibular retrognathia whatsoever. The posttreatment casts (Fig. 9) confirm correction of the Angle’s Class II relationship on the right side as well as correction of the deep overbite. The mandibular curve of Spee has been leveled. The posttreatment panoramic radiographs (Fig. 10) exhibit upright teeth with parallel roots. All third molars have been removed. The posttreatment cephalogram and its tracing (Fig. 11) confirms the maintenance of mandibular incisor position and reduction of ANB from 6° to 2°. The posttreatment Z angle is 80°. The superimpositions (Fig. 12) confirm
vertical control in the posterior area of the dentition and intrusion and retraction of the maxillary anterior teeth. Mandibular anterior teeth have been held in their pretreatment positions. What is noteworthy is the downward and forward change in mandibular position relative to maxillary position. This favorable change is desired during the correction of every Class II malocclusion. The pretreatment/posttreatment smiling photographs (Fig. 13) are testament to good Tweed-Merrifield directional force mechanics and vertical control.

It is hoped that this brief article and the accompanying case report illustrate this important concept of vertical control so that the patient’s genetic potential for mandibular change can express itself in a favorable direction.
The study compared anchorage control between two-step retraction and en masse retraction Fig 1.

Fig. 1: Schematic representation of the difference between the two retraction systems. The canine and the second bicuspid have been shaded to make the differences clearer. Row 1, Before retraction; Row 2, Intermediate stage. In the two-step method, the canines have been fully retracted to contact with the remaining bicuspid. In the en masse method, the extraction space has been partially reduced but the canine and the lateral incisor are still in contact.

The study design is shown in Fig. 2

Fig. 2: Flow chart of the study design
Pre-treatment demographics of the en masse and two-step groups are reported in Table I.

Table I - Pre-treatment Demographics

<table>
<thead>
<tr>
<th>Treatment Method</th>
<th>n</th>
<th>Starting Age</th>
<th>Sex</th>
<th>Angle Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>En masse</td>
<td>32</td>
<td>12.5 (11.8)</td>
<td>Male</td>
<td>Class I: 16</td>
</tr>
<tr>
<td>Two-step</td>
<td>31</td>
<td>12.7 (11.9)</td>
<td>Male</td>
<td>Class I: 16</td>
</tr>
</tbody>
</table>

*One patient, later lost to follow-up, has been deleted from the group statistics in this paper.

When both treatment groups were pooled, small but statistically significant sex and starting age differences in anchorage loss were detected. Boys had more anchorage loss than girls. Children who started treatment earlier had more anchorage loss than children whose treatment was started later.

Conclusions:

In this prospective randomized trial, a group of patients treated with an en masse retraction technique experienced slightly less anchorage loss on average than was observed in a comparable group treated using the more conventional “two-step” method of retraction. The observed difference, however, was not large enough to be statistically significant. Hence it would be inappropriate to assert that the en masse method consistently produces less anchorage loss on average than does the two-step method. But at the same time, the findings imply that the assertion that the en masse method produces significantly more anchorage loss than the two-step method is unlikely to be true.

When studying these findings, it is important to note that headgear was used by all patients in both treatment groups and that auxiliary anchorage (TPA) was used in the majority of cases in both treatment groups. Despite these precautions, average anchorage loss in both groups approximated or exceeded half the width of the crown of the extracted bicuspid teeth.
During treatment planning, orthodontic clinicians used to think more about crowding, the curve of Spee, anterior-posterior position of incisors, and the relationship of the maxillary and mandibular arches than about control of the vertical dimension.

Dr. Herb Klontz has stated, “We have three objectives when treating high angle patients: 1) Mandibular incisors must be upright over their bony support; 2) The position of maxillary incisors must be controlled: horizontally, vertically and in the third order; 3) Posterior vertical dimension must be controlled. To achieve these three objectives, a directional force system that controls the direction of our treatment must be used. Otherwise, orthodontic mechanotherapy, by its very nature, can be extrusive and cause downward and backward rotation of the mandible.”

The vertical dimension must be considered both diagnostically and mechanically. Records of three patients will be used to illustrate this concept: one was started without differential diagnosis and was treated with inappropriate mechanics; the other two were treated with directionally controlled forces and had balanced faces at the conclusion of treatment.

**Patient #1: Angle’s Class I – A correct treatment plan with poor force control.**

The facial photographs of this 12-year-old girl show a convex profile with a retrusive chin and incompetent lips. There is strain of the mentalis musculature (Fig.1-1). The intraoral photos (Fig. 1-1) illustrate the Class I dental occlusion with 2mm of crowding in the maxillary
arch and 5mm of crowding in the mandibular arch. The panoramic radiograph (Fig. 1-2) exhibits a normal dentition. The cephalogram and its tracing (Fig. 1-3, 4) confirms an average skeletal pattern with flaring of the maxillary and mandibular incisors. The craniofacial difficulty is 16. The total space deficit is 29.5mm. The total craniofacial and space difficulty deficit is 45.5. Actually, this patient does not have a difficult problem. The patient needs extraction of four first premolars. The patient’s parents however, would not allow any teeth to be extracted. They said they would accept the profile and only wanted to align the teeth. The author tried to align the teeth without extraction. After 10 months, the teeth were aligned, but the parents complained that their daughter’s face got worse (Fig. 1-5). They agreed to have four premolars extracted. The space was closed with so called “maximum anchorage” (Fig. 1-6) sliding mechanics without vertical control.

The posttreatment profile was slightly improved. The Z angle changed a little – 65.5° compared to 63° before treatment. The patient still had strain of the mentalis musculature (Fig. 1-7). The posttreatment lateral cephalogram and tracing (Fig. 1-8, 9) shows that the FMA, ANB and OccP increased and the facial height index worsened. The results of the retraction of the
incisors was negated by extrusion of the maxillary and mandibular molars and the clockwise mandibular rotation.

The lesson from this patient is that expansion to align teeth will result in vertical extrusion. When spaces are closed without vertical control, the mandible drops down and back (Fig. 1-10). The clinician must use differential diagnosis and a force system that incorporates vertical control of the dentition.
**Patient #2: An Angle’s Class II, division I, patient who had a severe bialveolar protrusion, a high angle skeletal pattern and a gingival smile. She was treated with four first premolar extractions.**

The pretreatment facial photos and cephalogram of this adult patient illustrate a protrusive convex profile with a gingival smile (Fig. 2-1, 2, 3, 4, 5). The FMA is 34° and the Z-angle is 54°. The craniofacial difficulty is 89, and the total craniofacial and space difficulty is 115.5.
Four first premolars were extracted. Mini-screws were placed between the maxillary first molars and the maxillary second molars for maximum retraction of incisors. A high-pull J hook headgear was used to reinforce the vertical correction of the maxillary incisors.

Posttreatment facial photographs confirm a very harmonious and charming profile with a nice smile line (Fig. 2-6). The casts exhibit ideal occlusion (Fig. 2-7). The FMA and the facial height index were well maintained, the mandibular incisors were uprighted from 99.5° to 88.5° and the maxillary incisors were retracted and intruded accordingly. The Z angle improved from 53° to 70° (Fig. 2-9, 10, 11). Third molars were scheduled to be extracted (Fig. 2-8).
**Patient #3: A 12-year-old patient presented with a high angle Angle’s Class II malocclusion. The patient was treated with the extraction of four first premolars and three first molars.**

This girl presented with a severe malocclusion and a poor facial profile. She had very protruded upper and lower lips and a retruded chin (Fig. 3-1). The intraoral photographs and casts illustrate the Class II occlusion (Fig. 3-1, 2). The panoramic film (Fig. 3-3) confirms that the third molars were present. The cephalogram and its tracing (Fig. 3-4, 5) confirmed a high angle skeletal pattern with flaring of maxillary and mandibular incisors. FMA was 36°, ANB was 6°, and the Z angle was only 45.5°. The craniofacial difficulty was 122.5. The total space deficit was 54mm with an anterior deficit of 26mm. The total craniofacial and space difficulty was 171.

The Tweed-Merrifield guidelines suggested that four first premolars and some molars should be extracted. The patient was treated with the 10-2 directional force system with a high pull J-hook headgear. Three first molars were extracted for further retraction of incisors.
Fig. 3-4: Pretreatment cephalometric radiograph

Fig. 3-5: Pretreatment cephalometric tracing

Fig. 3-6: Posttreatment photographs

Fig. 3-7: Posttreatment dental casts

Fig. 3-8: Posttreatment panoramic radiograph

Fig. 3-9: Posttreatment cephalometric radiograph
The results show a pleasing and harmonious face (Fig. 3-6). The facial convexity was reduced, the chin and the curvature of the lips were nice. The casts (Fig. 3-7) illustrate an acceptable posttreatment occlusion. The posttreatment panoramic radiograph (Fig. 3-8) illustrates third molar positions and the uprighting of teeth into the extraction sites. The cephalogram and its tracing (Fig. 3-9,10) show that the FMA was reduced to 35.5°, the ANB was reduced from 6° to 3°, the mandibular incisors were uprighted from 102° to 87.5° and the Z angle was increased to a pleasing 67°. The superimposition (Fig. 3-11) shows very nice vertical control and good mandibular response. These factors were keys to the successful treatment of this severe high angle patient.

**CONCLUSION**

The treatment outcomes of these three patents illustrate the fact that differential diagnosis and proper mechanics for vertical control are keys to excellent results for the correction of most malocclusions. We can achieve great treatment results for our patients if we respect these classic principles. For the growing patient, we must insure that our forces are harmonized with growth. This concept is particularly important for high angle patients. We cannot get the best result for our patients without proper diagnosis and a proper system for vertical control.

**REFERENCES:**

Various modalities have been used for non-surgical correction of the Class III malocclusion. These depend on the educational background and preference of the orthodontist and the condition of the patient. These modalities include: 1) a conventional edgewise appliance and Class III elastics with extraction or non-extraction, 2) Multiloop Edgewise Arch Wire (MEAW) with Class III and vertical elastics 3) retraction of the lower dentition by using springs from mandibular microimplants to the mandibular dentition and 4) retraction and uprighting of lower posterior teeth by using Class III elastics from maxillary microimplants. As microimplants developed, the technique using microimplants has been popular with all types of malocclusion, including the Class III.

This paper will present the use of Class III elastics from two maxillary microimplants to the maxillary dentition. This method is not only easy and simple, it is especially effective for Class III high angle patients who have mesially inclined mandibular posterior teeth and an anterior open-bite. (Fig. 1)

**Treatment Protocol** (Fig. 2)

1. Bond or band and place light initial wire (.014 NiTi).
2. Place microimplants with a diameter of 1.5mm, circular or a double head type between maxillary premolar and molar.

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**Fig. 1**: Skeletal Class III (Low and high angle): Low angle has deep bite and flat occlusal plane, while high angle has open bite and steep occlusal plane.

**Fig. 2**: Treatment protocol.
3. Use Class III elastics, 3/8 inch 5 oz. or 5/16 inch 5 oz., depending on the teeth involved (canines or first premolars) for 24 hrs a day except at meal time.

4. Following leveling increase the wire size from .014 NiTi to .016 or .016 x .022 NiTi or SS archwire.

5. If spaces were created between mandibular lateral incisor and canine or canine and first premolar, you could close them by using a loop or chain elastics with or without Class III elastics.

**Biomechanics**

The force is a simple tip back mechanism from the Class III elastics with absolute anchorage of microimplants instead of maxillary molars. Tipping is the easiest movement among tooth movements. As shown in Fig. 3-a, if a wire is placed in all posterior teeth which are tipped mesially, the second molar has tip back moment and an extrusive force while the first molar has a tip back moment and an intrusive force. The same effect is applicable to the premolars. As a result, all teeth have tip back moments and forces as shown in Fig. 3-b.

Finally, the second molar has a tip back moment with extrusive force, while the canine has a tip back moment with an intrusive force. However, if upward and backward force is applied to the canines or the first premolars, all the posterior teeth will be uprighted and retracted posteriorly and the mandibular occlusal plane will be decreased. The mechanism mentioned above should be effective to correct a Class III with open bite problem. After leveling and an increase in the wire size; the mandibular dentition will act as one unit. If Class III elastics are used continuously, the mandibular dentition will rotate counterclockwise and a posterior disclusion may be created (Fig. 3-c).

To illustrate the concepts which I have been describing, observe the following case report.

The patient was 35 years old. Her soft tissue profile was acceptable to Korean standards. On frontal view the chin has a slight deviation to the right. Her dentition

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**Fig. 3a:** Force system when wire was inserted bracket on the posterior teeth tipped mesially.

**Fig. 3b:** Force system when class III elastics were applied on the canines: all teeth will move tip back distally and extrusion of incisors.

**Fig. 3c:** Force system when wire size increased following leveling: lower dentition will act as one body. So, lower dentition will rotate counterclockwise if class III elastics were used continuously.
showed many problems such as a Class III molar and canine relationship, edge to edge bite, an open bite, and mesially tipped mandibular posterior teeth. The maxillary dentition had a very slight discrepancy but the mandibular dentition had 4.3 mm of crowding (Fig. 4a-c). Cephalometric measurements showed: ANB 0.2°, FMA: 29.3°, IMPA: 96.5 FMIA: 54.2°, and a mild skeletal Class III with open bite.

**TREATMENT PROCEDURE**

All the teeth were banded/bonded. Two MIs were placed in the maxilla between the premolar and first molar. Class III elastics were used from the MIs to the mandibular first premolars (Fig. 5 A, B, C). Every 4 weeks I checked the changes in the mandibular dentition and following leveling and uprighting of the posterior teeth, the wire size was increased to 16 X 22 SS in the lower arch. After 6 months, the patient showed good occlusion, no open-bite, a good interdigitation, and class I molar and canine relationship (Fig. 6 D, E). However, the patient complained about her dental midline not coinciding with her facial midline. She asked me to shift her dental midline slightly to the left in order to coincide with her facial midline. I tried to move her maxillary dentition to the left with a Niti coil spring. I then tried to move her mandibular dentition simultaneously to the left using Class III elastics (Fig. 6F). The patient was satisfied with the results after another 6 months. Her treatment was completed 15 months after beginning treatment (Fig 7a, b).

**TREATMENT RESULTS**

Superimposition of the cephalograms showed tremendous mandibular molar distal movement and tip back along with lingual tipping and extrusion of the mandibular incisors due to Class III elastic force. The occlusal plane angle was decreased (Fig 7c).
Postretention record
Retention records showed stable results (Fig. 8).

Summary
Microimplants in the maxillary arch provide absolute anchorage for Class III elastics. Class III elastics from microimplants to the mandibular dentition can move the mandibular dentition distally by uprighting the posterior teeth without any unfavorable changes to the maxillary dentition. Class III elastics from microimplants will decrease the steep occlusal plane angle. Two maxillary microimplants and Class III elastics can be an effective tactic for the treatment of a high angle, open bite Class III malocclusion.
Case Reports
A CASE REPORT OF CLASS II MALOCCLUSION
PATIENT WITH HIGH CANINE AND GUMMY SMILE

LEE YOU-JIN
BUSAN, SOUTH KOREA

DIAGNOSIS
The patient was an eleven year, four month old girl with a Class II, division 1 malocclusion which was complicated by high canines and “gummy” smile. The pretreatment facial photographs (Fig. 1) illustrate lip incompetence and an everted lower lip, with severe gingiva exposure upon smiling.

The maxillary canines are blocked-out due to the space deficiency. To protect the maxillary right first molar that had severe enamel hypoplasia, a band was placed at the very beginning of treatment.

The pretreatment panoramic x-ray (Fig. 3) confirms that all the second molars were developing. Third molars are present with seemingly insufficient room for eruption in the future.

In the pretreatment cephalometric analysis (Fig. 4a, 4b and Table 1) FMA is 32°, FMIA is 55°, IMPA is 94°, SNA is 78°, SNB is 71.5°, ANB is 6.5°, and the Z-angle is 58°. These values confirm that the patient is a high angle skeletal class II patient. The cranial facial analysis (Table 2) total was 108 and the total space analysis difficulty was 41. The total difficulty was, therefore 149.

The photographs of the casts (Fig. 2) reveal a full Class II molar relationship with a 5mm overbite. The maxillary incisors are extruded and relatively upright.
### Table 1: Pretreatment and posttreatment cephalometric measurements

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>NORMAL</th>
<th>PRE-TX</th>
<th>FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMIA</td>
<td>67</td>
<td>55.0</td>
<td>60.0</td>
</tr>
<tr>
<td>FMA</td>
<td>25</td>
<td>32.0</td>
<td>29.0</td>
</tr>
<tr>
<td>IMPA</td>
<td>88</td>
<td>93.0</td>
<td>91.0</td>
</tr>
<tr>
<td>SNA</td>
<td>82</td>
<td>78.0</td>
<td>77.0</td>
</tr>
<tr>
<td>SNB</td>
<td>80</td>
<td>71.5</td>
<td>83.5</td>
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<tr>
<td>ANB</td>
<td>2</td>
<td>6.5</td>
<td>3.5</td>
</tr>
<tr>
<td>AO-BO</td>
<td>2mm</td>
<td>1.0</td>
<td>-0.5</td>
</tr>
<tr>
<td>OCC PLANE</td>
<td>10</td>
<td>15.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Z ANGLE</td>
<td>75</td>
<td>58.0</td>
<td>70.0</td>
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<tr>
<td>UPPER LIP</td>
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<td>15.0</td>
<td>15.0</td>
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<tr>
<td>TOTAL CHIN</td>
<td></td>
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<td>13.0</td>
</tr>
<tr>
<td>POST. FACIAL HT</td>
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<tr>
<td>ANT. FACIAL HT</td>
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<td>FAC. HT. INDEX</td>
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<td>.75</td>
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<td>FAC. HT. CHANGE</td>
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<td></td>
<td>7.5</td>
</tr>
<tr>
<td>MAND. CUSPID WIDTH</td>
<td></td>
<td>26.5</td>
<td>26.5</td>
</tr>
<tr>
<td>MAND. MOLAR WIDTH</td>
<td></td>
<td>44.5</td>
<td>46.0</td>
</tr>
</tbody>
</table>

Fig. 4a: Pretreatment cephalogram
Fig. 4b: Pretreatment cephalometric tracing
The posttreatment records illustrate the correction of the malocclusion. The posttreatment facial photographs (Fig. 5) confirm improved facial and smile esthetics. The posttreatment casts (Fig. 6) illustrate the correction of the Class II molar and canine relationships, the deep overbite, and the space deficiency. The posttreatment cranial facial analysis provides a quantitative assessment of the treatment outcomes, with values and difficulty factors indicating the extent of the required adjustments.

Both the parents and the patient strongly wanted an immediate resolution of the patient’s esthetic problems. The maxillary first premolars and the mandibular second premolars were extracted without waiting for the full eruption of the second molars. Cooperation with the high pull J-hook headgear was critical for the correction of the patient’s excessive gingival display.

**RESULTS**

The posttreatment records illustrate the correction of the malocclusion. The posttreatment facial photographs (Fig. 5) confirm improved facial and smile esthetics. The posttreatment casts (Fig. 6) illustrate the correction of the Class II molar and canine relationships, the deep overbite, and the space deficiency. The posttreatment cranial facial analysis provides a quantitative assessment of the treatment outcomes, with values and difficulty factors indicating the extent of the required adjustments.

### Cranial Facial Analysis

<table>
<thead>
<tr>
<th>Normal Range</th>
<th>Ceph Value</th>
<th>Difficulty Factor</th>
<th>Difficulty</th>
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<tbody>
<tr>
<td>FMA 22° – 28°</td>
<td>32.0</td>
<td>5</td>
<td>20.0</td>
</tr>
<tr>
<td>ANB 1° – 5°</td>
<td>6.5</td>
<td>15</td>
<td>22.5</td>
</tr>
<tr>
<td>Z Angle 70° – 80°</td>
<td>58.0</td>
<td>2</td>
<td>24.0</td>
</tr>
<tr>
<td>Occ Plane 8° – 12°</td>
<td>15.0</td>
<td>3</td>
<td>9.0</td>
</tr>
<tr>
<td>SNB 78° – 82°</td>
<td>71.5</td>
<td>5</td>
<td>32.5</td>
</tr>
<tr>
<td>FHI 0.65 – 0.75</td>
<td>0.71</td>
<td>3</td>
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**C. F. Difficulty Total**

108.0

### Total Space Analysis

<table>
<thead>
<tr>
<th>Anterior</th>
<th>Value</th>
<th>Difficulty Factor</th>
<th>Difficulty</th>
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</thead>
<tbody>
<tr>
<td>Tooth Arch Disc</td>
<td>2.0</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Headfilm Disc</td>
<td>8.0</td>
<td>1</td>
<td>8.0</td>
</tr>
<tr>
<td>Soft Tissue Mod</td>
<td>4.0</td>
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<td><strong>Total</strong></td>
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<td>11.0</td>
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<table>
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<tr>
<th>Mid Arch</th>
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<tbody>
<tr>
<td>Tooth Arch Disc</td>
<td>0</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>Curve of Spee</td>
<td>2.0</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2.0</td>
<td></td>
<td>2.0</td>
</tr>
</tbody>
</table>

| Occlusal Disharmony (Class II or Class III) | 10.0 | 2 | 20.0 |
| **Total** | 12.0 | 22.0 |

<table>
<thead>
<tr>
<th>Posterior</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tooth Arch Disc</td>
<td>28.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected inc (—)</td>
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<td></td>
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<tr>
<td><strong>Total</strong></td>
<td>19.0</td>
<td>0.5</td>
<td>9.5</td>
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### Space Analysis

19

<table>
<thead>
<tr>
<th>C.F. Difficulty Total</th>
<th>108.0</th>
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<tbody>
<tr>
<td>S.A. Difficulty Total</td>
<td>44.5</td>
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<tr>
<td><strong>Total Difficulty</strong></td>
<td>152.5</td>
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</table>

<table>
<thead>
<tr>
<th>Index Difficulty:</th>
<th>Mid 0—60</th>
<th>Moderate 60—120</th>
<th>Severe 120+</th>
</tr>
</thead>
</table>

**Space Analysis Difficulty Total** 44.5

Table 2: Differential diagnostic analysis system
panoramic radiograph (Fig. 7) shows the parallel roots in the extraction sites and the well developing third molars. The posttreatment cephalogram and its tracing (Fig. 8a, 8b) reveal the well controlled maxillary incisors, the upright mandibular incisors, and an improved Z-angle. The cephalometric values are: FMIA 60°, FMA 29°, IMPA 91°, SNA 77°, SNB 73.5°, ANB 3.5°, and a Z-angle of 70°. The pretreatment and posttreatment composite cephalometric tracings (Fig. 9) illustrate a favorable mandibular response and good control of the dentition during treatment. Because the second molars erupted into the arches very slowly, the total treatment time was 36 months.

The patient’s facial profile (Fig. 10) and the smile (Fig. 11) were greatly improved as a result of orthodontic treatment.
A High Angle Class I Bimaxillary Protrusion Improved by Mandibular Response

Shigeki Takahashi
Hadano Kanagawa, Japan

Introduction
Faces first! It is well-known that facial balance can be achieved using the directional force system based on the Tweed-Merrifield philosophy. Mandibular response is a skeletal change of the mandible in an anterior and superior direction. It has been reported that in successful Class II treatment, FMA and ANB decrease and Facial Height Index (FHI) increases with an increase in Posterior Facial Height (PFH) and a decrease in Anterior Facial Height (AFH). These findings suggest that decreases in FMA and ANB and an increase in FHI may serve as indicators of mandibular response.

A high angle Class II bialveolar protrusion patient was treated successfully with the use of the Tweed-Merrifield directional force system. Not only did FMA and ANB decrease, but FHI markedly increased.

History and Findings
A 17-year 3 month old Japanese female patient presented with protruded maxillary anterior teeth and crowded mandibular teeth. The face was symmetrical on frontal view. The lips were protrusive in the profile view. Orbicularis oris and mentalis strains were noted on lip closure (Fig. 1). Her medical/dental history was unremarkable. Intraorally, mild gingivitis was present in the maxillary and mandibular anterior areas. The maxillary and mandibular dental midlines were not coincident. The mandibular dental midline was deviated 2.5mm to the right relative to the maxillary midline. The overjet and overbite were 6mm and 4mm, respectively. The molar relationship was Angle’s Class I on both sides. The maxillary right and left lateral incisors were lingually displaced. There was a moderate amount of crowding in the mandibular arch with a lingually displaced right lateral incisor and buccally displaced right canine and first premolar (Fig. 2).

Fig. 1: Pretreatment facial photographs
Fig. 2: Pretreatment Intraoral photographs
The pretreatment panoramic radiograph (Fig. 3) shows neither alveolar bone loss nor root resorption. All four third molars were impacted. She had no history of TMJ pain or trismus despite an opening click in the right joint. No premature deflective contact was present.

**Analysis**

The initial lateral cephalogram is shown in Fig. 4 and the initial cephalometric measurements in Table 1. SNB of 77° indicated mandibular retrusion. FMA of 36° and FHI of 0.61 indicated hyperdivergent skeletal pattern with clockwise rotation of the mandible. The mandibular incisors were proclined; confirmed by an FMIA of 49° and an IMPA of 95°. The lips were protrusive in the profile view with a Z-Angle of 61°. The Cranial Facial Analysis (Table 2) exhibited a cranial facial difficulty of 75. The Space Analysis (Table 3) showed a total space analysis deficit of 41.3mm, and a total space analysis difficulty deficit of 33.3. The values consisted of a total anterior difficulty of 17.3 with a large headfilm discrepancy of 12.8mm, a total midarch difficulty of 6.5 with a 3.5mm curve of Spee, and a total posterior difficulty of 9.5 with a posterior tooth arch discrepancy of 19mm. The total difficulty was 108.3.

**Diagnosis, Treatment Objectives and Treatment Planning**

The patient was diagnosed as having a high-angle Class I bialveolar protrusion malocclusion with moderate crowding. The problem list included 1) a high mandibular plane angle, 2) mandibular retrusion, 3) proclined mandibular incisors and 4) a lack of available space. The treatment goals were to 1) eliminate crowding, 2) upright the mandibular incisors, 3) establish a proper anterior overjet and overbite, 4) establish a solid occlusion, and 5) achieve facial balance. To achieve these goals, it was necessary to extract four first premolars and two mandibular third molars. This was explained to the patient and her consent to treatment was obtained. The patient was also informed of the need to extract two maxillary third molars during or at the end of retention. In addition, her cooperation was requested for the use of a high-pull J-hook headgear.

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>PRE-TX</th>
<th>POST</th>
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<tr>
<td>FMIA</td>
<td>49</td>
<td>61</td>
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<tr>
<td>FMA</td>
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<td>33</td>
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<td>IMPA</td>
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<td>86</td>
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<td>SNA</td>
<td>81</td>
<td>81</td>
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<td>SNB</td>
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<td>78</td>
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<tr>
<td>ANB</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>AO-BO</td>
<td>2mm</td>
<td>-1mm</td>
</tr>
<tr>
<td>OCC PLANE</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Z ANGLE</td>
<td>61</td>
<td>73</td>
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<td>UPPER LIP</td>
<td>11mm</td>
<td>11mm</td>
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<td>TOTAL CHIN</td>
<td>14mm</td>
<td>14mm</td>
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<tr>
<td>POST. FACIAL HT</td>
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<td>FAC. HT. INDEX</td>
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<td>.69</td>
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Table 1: Pretreatment and posttreatment cephalometric measurements
<table>
<thead>
<tr>
<th>Cranial Facial Analysis</th>
<th>Ceph Value</th>
<th>Difficulty Factor</th>
<th>Difficulty</th>
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<tbody>
<tr>
<td>FMA 22° – 28°</td>
<td>36</td>
<td>5</td>
<td>40</td>
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<tr>
<td>ANB 1° – 5°</td>
<td>4</td>
<td>15</td>
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<tr>
<td>Z Angle 70° – 80°</td>
<td>61</td>
<td>2</td>
<td>18</td>
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<tr>
<td>Occ Plane 8° – 12°</td>
<td>11</td>
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<td>0</td>
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<tr>
<td>SNB 78° – 82°</td>
<td>77</td>
<td>5</td>
<td>5</td>
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<tr>
<td>FHI 0.65 – 0.75</td>
<td>0.61</td>
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<td>12</td>
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<tr>
<td>C. F. Difficulty Total</td>
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<td><strong>75</strong></td>
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Table 2: Cranial facial analysis

<table>
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<th>Total Space Analysis</th>
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<tr>
<td>Anterior</td>
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<tr>
<td>Tooth Arch Disc</td>
<td>3.0</td>
<td>1.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Headfilm Disc</td>
<td>12.8</td>
<td>1</td>
<td>12.8</td>
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<tr>
<td>Total</td>
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<td>17.3</td>
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<td>Mid Arch</td>
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<td>Tooth Arch Disc</td>
<td>3.0</td>
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<td>3.0</td>
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<tr>
<td>Curve of Spee</td>
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<td>3.5</td>
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<tr>
<td>Total</td>
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<td>0</td>
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<td>Total</td>
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<td></td>
<td>0</td>
</tr>
<tr>
<td>Posterior</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tooth Arch Disc</td>
<td>19.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected inc (—)</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19.0</td>
<td>0.5</td>
<td>9.5</td>
</tr>
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</table>

Table 3: Total space analysis

<table>
<thead>
<tr>
<th>Total S.A.</th>
<th>S.A. DIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>15.8</td>
</tr>
<tr>
<td>Mid Arch</td>
<td>6.5</td>
</tr>
<tr>
<td>Posterior</td>
<td>19.0</td>
</tr>
<tr>
<td>Total</td>
<td>41.3</td>
</tr>
</tbody>
</table>
an essential part of her orthodontic therapy for facial improvement.

**TREATMENT RESULTS**
After 2 years and 8 months of active treatment, a well-balanced, pleasing facial profile was obtained (Fig. 5). Mentalis strain was eliminated, resulting in an improvement of soft tissue contour of the chin. The frontal view of the face also exhibits improved lip contour without orbicularis oris strain. The posttreatment intraoral photographs (Fig. 6) demonstrate the elimination of crowding, coincidence of the dental midlines and establishment of a solid occlusion. The overjet was reduced from 6mm to 2mm and the overbite from 4mm to 2mm. The maxillary and mandibular arch forms were also improved. Fig. 7 shows the posttreatment panoramic radiograph. Root parallelism was established with no change in alveolar bone height. No obvious root resorption was found, although the root apices of the maxillary and mandibular anterior teeth appear to be slightly more rounded than before treatment.

The posttreatment cephalometric analysis (Table 1) reveals favorable changes in FMA from 36˚ to 33˚, SNB from 77˚ to 78˚, ANB from 4˚ to 3˚, AO-BO from 2mm to -1mm, PFH from 45mm to 50mm, FHI from 0.61 to 0.69, FMIA from 49˚ to 61˚, IMPA from 95˚ to 86˚ and Z-Angle from 61˚ to 73˚. Superimposition on the S-N plane (Fig. 8) shows counterclockwise rotation of the mandible with associated forward movement of the chin. The upper and lower lips moved back 4mm.

Maxillary superimposition along the palatal plane reveals 3mm of mesial movement of the maxillary first molar. The maxillary central incisor was intruded 3mm at the root apex and retracted 8mm at the incisal edge. Superimposition on the mandibular plane shows that the mandibular first molar was intruded 1mm and moved mesially 2mm. The mandibular central incisor was intruded 4mm at the root apex and moved lingually 4mm at the incisal edge.

**CONCLUSION**
Treatment was initiated at the age of 17y3m and finished at 20y1m. Judging from the growth pattern of Japanese females at this age, there seemed to be little potential for mandibular growth. However, successful uprighting of the mandibular incisors, superior and posterior movement of the maxillary incisors, and a favorable mandibular response were achieved with treatment planning based on the Tweed-Merrifield philosophy and patient compliance with a J-hook to
both the maxilla and mandible. All these changes led to a pleasing facial profile.

FMA changed from 36° to 33°, PFH from 45mm to 50mm, and the resultant change in FHI was from 0.61 to 0.69. These favorable changes suggest successful vertical control with the directional force system. Superimposition of pretreatment and posttreatment cephalometric tracings also demonstrates vertical control with a good mandibular response.

Fig. 8: The pretreatment and posttreatment composite cephalometric tracings

SNAPSHOTS FROM THE TWEED COURSE
This case report is presented to illustrate the correction of a skeletal Class II div. 1 malocclusion which was complicated by a full step Class II molar relationship in a brachycephalic patient.

**Pretreatment Records**

The pretreatment facial photographs exhibit a thirty-four-year-old Korean female who has an acceptable facial profile and a brachycephalic facial pattern as evidenced by the broad mandible. The frontal view shows the relatively short lower third of the face. There is a small naso-labial angle and slight deepening of the lip-chin sulcus while her chin looks moderately pronounced. On the photographs of her smile, her esthetic problems are definitely noticeable. Her full smile doesn’t sufficiently reveal maxillary incisors that are protruded.

The photographs of the casts show a deep impinging overbite with a deep curve of Spee. The lateral views reveal a full step Class II molar relationship. There is no maxillary crowding and 4mm of anterior spacing in the mandibular arch. The pretreatment panoramic radiograph illustrates a healthy dentition with no third molars.

In the pretreatment cephalometric tracing FMA is $19.5^\circ$ and the vertical height index is .75. These values confirm a closed facial pattern with a deep overbite. ANB is only $4^\circ$. The occlusal plane of $5.0^\circ$ is noticeably
The patient’s craniofacial difficulty is only 21.5°. In the space analysis there is no space deficiency, only a Class II dental relationship. The patient’s total difficulty is 51.5.

**TREATMENT PLAN**

How would you treat this patient? There seems to be no reason to extract mandibular premolars. There is mandibular anterior spacing that can be used to level the curve of Spee. The headfilm correction was not used because of the low mandibular plane angle.

What will you do in the maxillary arch to reduce the overbite and correct the molar relationship? You could extract the maxillary premolars and try to preserve the Class II molar relationship. But extractions might decrease the vertical dimension and flatten the profile. This scenario would make her look old for her age.

I had to treat the dental class II pathology with tools which would preserve the vertical dimension, protect the profile and improve the exposure of the maxillary anterior teeth. I concluded that nonextraction treatment might be the best approach. The Tweed-Merrifield directional force system is well designed to solve these problems effectively. The Class II force system was used.

**POSTTREATMENT RECORDS**

The pretreatment/posttreatment facial photographs exhibit the facial change. On profile the labio-mental sulcus was softened and the upper and lower lip relationship was slightly improved. Her naso-labial angle remains the same but her upper lip is less tense. Her smile has improved greatly after treatment because the treatment increased her tooth exposure.

The pretreatment/posttreatment casts reveal a reduced overjet and overbite with a well interdigitated Class I occlusion.

The pretreatment/posttreatment panoramic radiographs show no dental pathology. Despite the use of Class II
Pretreatment and posttreatment facial photographs

Pretreatment and posttreatment dental casts

Pretreatment and posttreatment panoramic radiographs

Pretreatment and posttreatment cephalograms
elastics, the mandibular posterior teeth are upright due to anchorage preparation.

The comparison of pretreatment / posttreatment cephalograms exhibits the changes of the vertical position of upper and lower incisors with a flattened curve of Spee.

The craniofacial values changed little during treatment, but the occlusal plane was proclined because of the intrusion of the mandibular incisors. FMIA decreased from 65.0° to 62.0°. ANB was unchanged. The vertical dimension was relatively well preserved.

The Z angle value remained stable as expected and the esthetic line intersected the nose after treatment. If more attention had been focused on mandibular anchorage preparation, FMIA would have remained more stable.

The superimpositions show the changes in the vertical position of the maxillary and mandibular incisors. The mandibular incisors were intruded while the maxillary incisors were retracted and extruded. The maxillary first molars moved distally with slight mesial movement of the mandibular first molars.

Total active treatment time was 20 months. The nice result was achieved due to proper application of Tweed Merrifield forces and great cooperation from the patient. She is very satisfied with the result.

The non extraction treatment approach gave a good result to this brachycephalic patient because of the use of the Tweed Merrifield directional force system.
The patient was a 37 year old male with a Class III malocclusion. He presented with imbalance of the soft tissue. His lower lip was procumbent, and his Z angle was 70° (Fig 1). He had been told by several orthodontists that his treatment would require orthognathic surgery in order to achieve the desired result. Careful examination of the records indicated that successful treatment would not require surgical intervention unless a specific facial change was desired by the patient.

His significant medical history consisted of a subcondylar fracture of the left mandibular condyle which required an open reduction with the use of plates and screws to stabilize the segments (Fig 2). Subsequent to the reduction, he reported periodic pain in the left condylar area with occasional grating, popping and clicking of the left TMJ. There were no functional limitations in lateral excursions or in maximal opening.

Skeletally, he demonstrated a balanced maxillo/mandibular relationship (Fig 3). The lateral cephalogram indicated that the mandibular incisors were flared relative to basal bone.

Dentally, he presented with a Class III malocclusion, anterior crossbite, a missing maxillary left second molar, and a moderate tooth size-arch length discrepancy in the mandibular arch (Fig 4). There was a 3.0mm curve of Spee. The Total Space Analysis Difficulty was 38.8.
**TREATMENT PLAN**

The treatment options included extraction of maxillary second and mandibular first premolars, extraction of the maxillary right third molar and the mandibular third molars and use of the MEAW\(^1\) technic or extraction of the maxillary first premolars and mandibular second premolars with mandibular setback surgery.

Standard edgewise .022 brackets were bonded to all available teeth after extraction of three third molars. After the arches were leveled and aligned, 8mm TADS were placed mesial to the maxillary first molars. These were placed in order to use class III elastics to the mandibular MEAW in order to tip back and retract the mandibular dental arch into a proper class I relation with ideal overbite and overjet. The mandibular MEAW is a .017 X .022 stainless steel wire that is bent with loops between each tooth from the mesial of the canines posteriorly. Each loop is tipped 3 – 5 degrees which produces a reverse curve of Spee for the arch wire (Fig 5). This archwire is then supported with class III elastics (6 oz. 1/4”) that are worn full time from either the TADS in the maxilla or from the maxillary archwire. The arch wire will work with a light continuous force to tip the posterior teeth distally, intrude the posterior teeth, and with the help of the class III elastics, rotate the occlusal plane in a counter-clockwise direction.
Results
Treatment was completed in 25 months, even with a four month absence of the patient due to financial difficulty. The face exhibits less lip protrusion and a great smile (Fig. 6). The posttreatment cephalogram (Fig. 7) confirms that mandibular incisor position was maintained, the occlusal plane was rotated counter-clockwise, and the Z angle was improved. The dental casts (Fig. 8) show a solid class I canine and molar relationship with the posterior teeth out of occlusion (Tweed occlusion) and ideal overbite and overjet. Unfortunately, there are no cephalometric superimpositions due to the fact that our office switched to a digital pan/ceph machine midway through treatment. The space for the missing maxillary left second molar was closed.

Reference

Snapshots from the Tweed Course