Orthodontic Correction of Adult Gummy Smile with TADs and Periodontal Surgery

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- DDS, National Taiwan University, 1988
- MS, Chang Gun Medical University, 2009
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- Visiting staff, Shin Kong Memorial Hospital, 1994~2002
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Gummy smile

Parameters for evaluation
Differential Diagnosis
Treatment options
TADs & Periodontal surgery
Discussions
Gummy smile

Excessive gingival display during smile
More than 2-4 mm

which is considered unattractive by lay people and general dentists

Incisor show at rest

2~4 mm of incisor show at rest
Female: 3.4 mm  Male: 1.9 mm

Differential Diagnosis of Gummy smile

- **Supereruption** of upper anteriors
- **Vertical Maxilla Excess**
- Short clinical crowns
- **Altered passive eruption**
- Short upper lip
- **Hypermobility of upper lip**
- **Protrusion of upper anteriors**
Etiology

- **Supereruption** of upper anteriors
- Intrusion of upper anteriors
Differential Diagnosis of Gummy smile

- Supereruption of upper anteriors
- Vertical Maxilla Excess
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- Hypermobility of upper lip
- Protrusion of upper anteriors
The long face syndrome: Vertical maxillary excess


Dallas, Texas

A clinically recognizable facial morphology, the long face syndrome, is manifested primarily by excessive lower vertical facial height. Although this dysmorphism has been most commonly classified as a skeletal type of open-bite, it is apparent that the syndrome has been discussed under numerous other titles.†-13 Extreme clockwise rotation, high angle type, adenoid faces, idiopathic long face, total maxillary alveolar hyperplasia, and vertical maxillary excess all have excessive vertical growth of the maxilla as their common denominator.14-21
**Vertical Maxilla Excess**

- Long face
- Increased LAFH
- High MPA
- Normal upper lip length
- Excessive incisor show at rest

UAFH : LAFH = 45% : 55%

LeFort I impaction + BSSO setback + Genioplasty
Etiology

Vertical Maxilla Excess

Le Fort I impaction of Mx
Differential Diagnosis of Gummy smile

- Supereruption of upper anteriors
- Vertical Maxilla Excess
- Short clinical crowns
- Altered passive eruption
- Short upper lip
- Hypermobility of upper lip
- Protrusion of upper anteriors
Short clinical crown

Average length of upper central incisors
Male: 10.6 mm  Female: 9.6 mm

Width / length: 78~80%

Etiology

- Short clinical crown with attrition

Composite buildup
Differential Diagnosis of Gummy smile

- Supereruption of upper anteriors
- Vertical Maxilla Excess
- Short clinical crowns
- Altered passive eruption
- Short upper lip
- Hypermobility of upper lip
- Protrusion of upper anteriors
Etiology

- Altered passive eruption without attrition

Periodontal surgery
Differential Diagnosis of Gummy smile

- Supereruption of upper anteriors
- Vertical Maxilla Excess
- Short clinical crowns
- Altered passive eruption
- Short upper lip
- Hypermobility of upper lip
- Protrusion of upper anteriors
Short upper lip

Normal **upper lip length** is about

23mm in males

and 20mm in females

roughly equal to **commissure height**

Vertical lip changes from maxillary incisor retraction

Joe D. Jacobs, D.M.D., M.S.D.*
Dallas, Texas

Summary and conclusions

Pre- and posttreatment cephalometric roentgenograms of eleven male and nine female white patients treated with first premolar extraction for Class II, Division 1 malocclusions were analyzed to assess lip changes in the vertical dimension relative to orthodontic retraction of maxillary incisors. The following conclusions were drawn from the results obtained:

1. Closure of the interlabial gap (ΔLS-LI) occurs predictably when correlated with both horizontal and vertical movement of the maxillary incisors during retraction.

2. The interlabial gap closes vertically at a ratio of approximately 1 mm. for every 2 mm. of horizontal retraction of maxillary incisors if neither extrusion nor intrusion occurs during such retraction.

2:1

V-Y Cheiloplasty
to lengthen the short upper lip

However...

Not so predictable

Plastic surgeons are reluctant

Scar tissue may cause contraction
Etiology

- Short upper lip

Extractions

Retraction

V-Y cheiloplasty
Differential Diagnosis of Gummy smile

- Supereruption of upper anteriors
- Vertical Maxilla Excess
- Short clinical crowns
- Altered passive eruption
- Short upper lip
- Hypermobility of upper lip
- Protrusion of upper anteriors
Lip elevation at smile

Average distance that the upper lip travels from repose to a full smile

6 ~ 9 mm
Etiology

Hypermobility of upper lip

Botox
Temporary effect

6 Months
Etiology

- Hypermobility of upper lip

Myotomy of lip elevator muscles

Etiology

- Hypermobility of upper lip

Lip repositioning

Eliminating a Gummy Smile with Surgical Lip Repositioning, The Journal of Cosmetic Dentistry • Spring 2007, Simon, Rosenblatt, Dorfman
Etiology

- Hypermobility of upper lip
- Botox
- Myotomy
- Lip repositioning procedure
Differential Diagnosis of Gummy smile

- Supereruption of upper anteriors
- Vertical Maxilla Excess
- Short clinical crowns
- Altered passive eruption
- Short upper lip
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Vertical lip changes from maxillary incisor retraction

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Pre- and posttreatment cephalometric roentgenograms of eleven male and nine female white patients treated with first premolar extraction for Class II, Division 1 malocclusions were analyzed to assess lip changes in the vertical dimension relative to orthodontic retraction of maxillary incisors. The following conclusions were drawn from the results obtained:

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2. The interlabial gap closes vertically at a ratio of approximately 1 mm. for every 2 mm. of horizontal retraction of maxillary incisors if neither extrusion nor intrusion occurs during such retraction.

2:1
Etiology

Protrusion of upper anterior
Extraction & Retraction
Treatment options

- Le Fort I impaction of Mx
- Intrusion of upper anteriors
- Periodontal surgery
- Botox
- Lip reposition
- V-Y Cheiloplasty
- Retraction of upper anteriors
Orthodontic Treatment to correct Gummy smile

- **Intrusion** of upper anteriors
- **Retraction** of upper anteriors
- **Periodontal surgery**
Intrusion of upper anteriors

- Anterior TADs
- Subapical placement
What happened to periodontal tissue during incisor intrusion?
Clinical crowns were shortened

Upper incisor intrusion by 2 mm

Mucogingival line unchanged

Clinical crowns were shortened
Periodontal changes after experimentally induced intrusion of the upper incisors in *Macaca fuscata* monkeys

Teruo Murakami, DDS, Shigeru Yokota, DDS, DDSc,* and Yasuhide Takahama, DDS, DMSc**
Fukuoka, Japan

We are studying the biologic aspects of vertical movement of teeth, which are often used in orthodontic treatment involving variations in alveolar tissue. In the present study, the four upper incisors of five infant *Macaca fuscata* monkeys were intruded vertically from 1.1 to 5.5 mm. The following effects were examined: (1) movement of the gingiva, (2) change in the depth of the gingival sulcus, and (3) microscopic effects on the alveolar tissue. The results were as follows. (1) The ginciva moved in the same direction that the teeth were intruded, but only about 60% as far. (2) The clinical crown shortened and the gingival sulcus deepened. The shortening of the crown and the deepening of the sulcus were both approximately 40% as much as the tooth intrusion. (3) There was no inflammation or swelling microscopically in the gingiva of either the experimental animals or the controls. (4) The epithelium was always attached in the cementoenamel junction, even when the tooth was intruded. As the tooth intrusion was increased, the dentoperiosteal fiber (DPF) and the dentogingival fiber (DGF) terminating in the cementum gradually parted from it; when the tooth was intruded more than 5.0 mm, few fibers terminated in the cementum. It was concluded that the gingival sulcus deepened with horizontal tooth intrusion because of an accumulation of gingival tissue applied with good oral hygiene—not because of swelling around the gingival margin or apical movement of the gingival pocket—and the DPF and the DGF were parted from the cementum gradually as the tooth intrusion increased. (Am J Orthod Dentofacial Orthop 1989;95:115-26.)
Retraction of anteriors

- **Posterior TADs**
- **IZC** placement for upper
- **Buccal Shelves** for lower
Vertical lip changes from maxillary incisor retraction

Joe D. Jacobs, D.M.D., M.S.D.*

Dallas, Texas

Periodontal surgery

- Gingivectomy
- Crown lengthening
**Biological width**

- **Enamel**
- **Sulcular Depth**
- **Junctional Epithelium**
- **Connective Tissue Attachment**
- **Movable mucosa**

**Key Structures**:
- **Dentin**
- **CEJ**
- **PDL**
- **Bone**
simultaneous upper and lower molar intrusion along with upper and lower incisor intrusion

upper molar distalization 5 mm
upper incisor retraction 11 mm
lower incisor intrusion 2 mm
lower incisor retraction 8 mm
lower molar intrusion 2 mm
lower molar mesialization 2 mm

mandibular plane rotated counterclockwisely
upper incisor retraction 6.5 mm
upper molar mesialization 2.5 mm
upper molar intrusion 5 mm
upper incisor intrusion 6 mm
lower incisor retraction 7.5 mm
lower molar mesialization 1 mm
lower molar intrusion 2.5 mm
lower incisor intrusion 2 mm
How to deal with Vertical Maxillary Excess?

Active vertical control!
Maximize active vertical control to rotate mandible CCW

- Anterior TADs for incisor intrusion
- Posterior TADs for molar intrusion & maximal retraction
- Palatal arch or lingual arch if necessary
- Active vertical control on both arches
Anterior TADs for bite opening
Closed method of Anterior TADs
Comparison of the intrusion effects on the maxillary incisors between implant anchorage and J-hook headgear

Toru Deguchi, Takashi Murakami, Shingo Kuroda, Toshinori Yabuuchi, Hiroshi Kamioka, and Teruko Takano-Yamamoto
Okayama, Japan

Introduction: Recently, miniscrews have been used to provide anchorage during orthodontic treatment, especially for incisor intrusion. Miniscrews during incisor intrusion are commonly used in implant orthodontics. Traditionally, effective incisor intrusion has been accomplished with J-hook headgear. In this study, we compared the effect of incisor intrusion, force vector, and amount of root resorption between implant orthodontics and J-hook headgear. Methods: Lateral cephalometric radiographs from 8 patients in the implant group and 10 patients in the J-hook headgear group were analyzed for incisor retraction. The estimated force vector was analyzed in the horizontal and vertical directions in both groups. Root resorption was also measured on periapical radiographs. Results: In the implant group, significant reductions in overjet, overbite, maxillary incisor to palatal plane, and maxillary incisor to upper lip were observed after intrusion of the incisors. In the J-hook headgear group, significant reductions in overjet, overbite, maxillary incisor to upper lip, and maxillary incisor to SN plane were observed after intrusion of the incisors. There were significantly greater reductions in overbite, maxillary incisor to palatal plane, and maxillary incisor to upper lip in the implant group than in the J-hook headgear group. Estimated force analysis resulted in significantly more force in the vertical direction and less in the horizontal direction in the implant group. Furthermore, significantly less root resorption was observed in the implant group compared with the J-hook headgear group. Conclusions: The maxillary incisors were effectively intruded by using miniscrews as orthodontic anchorage without patient cooperation. The amount of root resorption was not affected by activating the ligature wire from the miniscrew during incisor intrusion. (Am J Orthod Dentofacial Orthop 2008;133:654-60)
**Table III. Comparison of pretreatment and postintrusion measurements**

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Significant difference between pretreatment and postintrusion: *P < 0.05; †P < 0.01; ‡Significant difference between groups (P < 0.05).
Treatment effects of intrusion arches and mini-implant systems in deepbite patients

Neslihan Ebru Şenışıka and Hakan Türkkahramanb
Isparta, Turkey

Introduction: The purpose of this study was to compare the skeletal and dental effects of 2 intrusion systems involving mini-implants and the Connecticut intrusion arch in patients with deepbites. Methods: The study sample consisted of 45 adults (26 women, 19 men) with deepbites. They were divided into 3 groups: 2 treatment groups and 1 untreated control group (15 subjects in each group). The Connecticut intrusion arch and the implant groups underwent maxillary incisor intrusion with Connecticut intrusion arches and a mini-implant system, respectively. During the 7-month study period, no other treatment was performed with the exception of maxillary incisor intrusion. Results: The mean amounts of genuine intrusion were 2.20 mm (0.31 mm per month) in the Connecticut intrusion arch group and 2.47 mm (0.34 mm per month) in the implant group. No statistically significant differences were found in the extent of maxillary incisor intrusion between the 2 intrusion systems (P >0.05). Both systems led to protrusion and intrusion of the maxillary incisors (P <0.05), and protrusion and extraction of the mandibular incisors (P <0.05). In the Connecticut intrusion arch group, the maxillary molars were extruded by moving the crown distally and the root mesially. The 2 intrusion systems were statistically different in the extent of alterations in the axial inclinations of the maxillary molars (P <0.05). Conclusions: Both the Connecticut intrusion arch and the mini-implant intrusion systems successfully intruded the 4 maxillary incisors. Although the movement of the maxillary molars led to the loss of sagittal and vertical anchorages during intrusion of the incisors in the Connecticut intrusion arch group, these anchorages were maintained in the implant and control groups. (Am J Orthod Dentofacial Orthop 2012;141:723-33)
2.20 mm  
No significant difference  
2.47 mm  
7 months
Comparison of the intrusive effects of miniscrews and utility arches

Ömür Polat-Özsoy, Ayça Arman-Özçirpici, Firdevs Veziroğlu, and Alev Çetinşahin
Ankara, Turkey

Introduction: The aim of this prospective study was to compare the effects of incisor intrusion obtained with the aid of miniscrews and utility arches. Methods: Twenty-four patients (10 male, 14 female) with a deepbite of at least 4 mm were divided into 2 groups. In group 1, 13 patients (3 male, 10 female; mean age, 20.90 ± 7.12 years) in the postpubertal growth period were treated by using miniscrews; in group 2, 11 patients (7 male, 4 female; mean age, 15.25 ± 3.93 years) were treated with utility arches. Lateral cephalometric headfilms were taken at the beginning of treatment and after intrusion for the evaluation of the treatment changes. Statistical analyses of the data were performed with a significance level of \( P < 0.05 \). Results: Intrusion lasted 6.61 ± 2.95 months for group 1 and 6.61 ± 2.46 months for group 2. The changes in the center of resistance of the incisors were 1.75 ± 0.4 mm \( (P < 0.05) \) for group 1 and 0.86 ± 0.5 mm \( (P > 0.05) \) for group 2; the difference between the groups was significant \( (P < 0.05) \). In the miniscrew group, the incisors were protruded 0.79 ± 1.4 mm \( (P > 0.05) \) relative to pterygoid vertical and 3.85° ± 2.4° \( (P > 0.05) \) relative to the palatal plane. In group 2, the incisors showed 3.91 ± 0.7 mm \( (P < 0.05) \) of protrusion relative to pterygoid vertical and 13.55° ± 2.4° \( (P < 0.05) \) relative to the palatal plane. The maxillary first molars showed significant distal tipping in group 2 \( (P < 0.05) \). Conclusions: Unlike with utility arches, true maxillary incisor intrusion can be achieved by application of intrusive forces close to the center of resistance by using miniscrews with no counteractive movements in the molars. (Am J Orthod Dentofacial Orthop 2011;139:526-32)
How about Open technique?

Effective!
Anterior retraction might be interfered with anterior TADs.
Anterior retraction might be interfered with anterior TADs
Is it a must for all gummy cases to have a periodontal surgery?

Not necessarily!
No crown lengthening as gingival line was hidden.
Limitations of gummy smile correction in adults

Some plastic surgeries might be considered

Patient communication!
upper incisor retraction 9 mm
upper incisor intrusion 4 mm
upper molar distalization 2 mm
upper molar intrusion 2.5 mm
lower incisor retraction 7 mm
lower incisor intrusion 1.5 mm
lower molar mesialization 5 mm
lower molar intrusion 5.5 mm
Pre-Tx

Orthodontic Tx

Rhinoplasty

Chin augmentation
How about Lip hypermobility?

Not effective!
Does incisor intrusion with TADs lead to more apical root resorption?
Apical root resorption in orthodontic patients with en-masse maxillary anterior retraction and intrusion with miniscrews

Eric J. W. Liou\textsuperscript{a} and Peter M. H. Chang\textsuperscript{b}
Taipei, Taiwan

Introduction: The purposes of this retrospective study were to investigate the apical root resorption of maxillary incisors in orthodontic patients with en-masse maxillary anterior retraction and intrusion with miniscrews and the factors disposing a patient to apical root resorption. Methods: Fifty adult patients with maxillary protrusion were included; 30 were treated with miniscrews and extraction of the maxillary first premolars (group I), and 20 were treated with extraction of the maxillary first premolars (group II). For each patient, periapical films of the maxillary incisors and lateral cephalometric radiographs were taken before and after treatment to evaluate apical root resorption and cephalometric measurements. The intergroup differences were analyzed with the Student $t$ test and the correlations between apical root resorption and cephalometric measurements were analyzed by the Pearson correlation. Results: The apical root resorption values were 16.0\% to 20.0\% (2.5–2.8 mm) in group I and 13.4\% to 14.4\% (2.1–2.3 mm) of the original root length in group II. Group I had significantly more severe Class II jaw discrepancy (ANB, 7.1° ± 1.9°) than did group II (ANB, 3.2° ± 2.9°). The amount of maxillary en-masse anterior retraction (8.2 ± 2.4 mm), the duration of treatment (28.3 ± 3.7 months), and apical root resorption of maxillary lateral incisors were significantly greater in group I than in group II. Apical root resorption of the maxillary central incisors was significantly correlated to the duration of treatment but not to the amount of en-masse retraction, intrusion, or palatal tipping of maxillary incisors. Conclusions: Miniscrew anchorage allows for more maxillary en-masse anterior retraction in patients with severe Class II cases. But the time needed for the greater amount of maxillary en-masse anterior retraction with miniscrew anchorage is longer and might dispose the patient to more apical root resorption. (Am J Orthod Dentofacial Orthop 2010; 137:207–12)
Comparison of the intrusion effects on the maxillary incisors between implant anchorage and J-hook headgear

Toru Deguchi, Takashi Murakami, Shingo Kuroda, Toshinori Yabuuchi, Hiroshi Kamioka, and Teruko Takeo-Yamamoto
Okayama, Japan

Introduction: Recently, miniscrews have been used to provide anchorage during orthodontic treatment, especially for incisor intrusion. Miniscrews during incisor intrusion are commonly used in implant orthodontics. Traditionally, effective incisor intrusion has been accomplished with J-hook headgear. In this study, we compared the effect of incisor intrusion, force vector, and amount of root resorption between implant orthodontics and J-hook headgear. Methods: Lateral cephalometric radiographs from 8 patients in the implant group and 10 patients in the J-hook headgear group were analyzed for incisor retraction. The estimated force vector was analyzed in the horizontal and vertical directions in both groups. Root resorption was also measured on periapical radiographs. Results: In the implant group, significant reductions in overjet, overbite, maxillary incisor to palatal plane, and maxillary incisor to upper lip were observed after intrusion of the incisors. In the J-hook headgear group, significant reductions in overjet, overbite, maxillary incisor to upper lip, and maxillary incisor to SN plane were observed after intrusion of the incisors. There were significantly greater reductions in overbite, maxillary incisor to palatal plane, and maxillary incisor to upper lip in the implant group than in the J-hook headgear group. Estimated force analysis resulted in significantly more force in the vertical direction and less in the horizontal direction in the implant group. Furthermore, significantly less root resorption was observed in the implant group compared with the J-hook headgear group. Conclusions: The maxillary incisors were effectively intruded by using miniscrews as orthodontic anchorage without patient cooperation. The amount of root resorption was not affected by activating the ligature wire from the miniscrew during incisor intrusion. (Am J Orthod Dentofacial Orthop 2008;133:654-60)
Many studies have analyzed the suspected causes of external apical root resorption (EARR). Particularly, amount of force, duration of active treatment, and amount of lingual root torque were suggested as factors in EARR. Intruding mechanics has also been considered a factor related to EARR.

In our study, root resorption averaged 0.8 mm in the implant group and 1.2 mm in the J-HG group. The amount of root resorption in both groups was similar to that of previous studies about root resorption during orthodontic treatment.

Toru Deguchi, et al, Comparison of the intrusion effects on the maxillary incisors between implant anchorage and J-hook headgear  Am J Orthod Dentofacial Orthop 2008; 133:654-60
Risk of EARR

- Amount of force
- Duration of active treatment
- Amount of lingual root torque
- Amount of intrusion
Table IV. Other variables

<table>
<thead>
<tr>
<th></th>
<th>Implant</th>
<th></th>
<th>J-HG</th>
<th></th>
<th>Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Mean</td>
<td>SD</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Vertical force (g)</td>
<td>59.5</td>
<td>97.9</td>
<td>89.7</td>
<td>6.1</td>
<td>50.2</td>
<td>73.1</td>
</tr>
<tr>
<td>Horizontal force (g)</td>
<td>24.2</td>
<td>42.1</td>
<td>32.1</td>
<td>13.3</td>
<td>38.2</td>
<td>78.5</td>
</tr>
<tr>
<td>Intusion duration (mo)</td>
<td>6</td>
<td>8</td>
<td>6.6</td>
<td>0.7</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Root resorption rate (mm)</td>
<td>0.3</td>
<td>1.4</td>
<td>0.8</td>
<td>0.4</td>
<td>0.5</td>
<td>1.7</td>
</tr>
</tbody>
</table>

NS, Not significant between groups (P < 0.05); Min, minimum; Max, maximum.

Root resorption 0.8 mm
Force type Transient
1.2 mm
Intermittent

Toru Deguchi, et al, Comparison of the intrusion effects on the maxillary incisors between implant anchorage and J-hook headgear  Am J Orthod Dentofacial Orthop 2008; 133:654-60
Root resorption?

Cortical plate?

6 mm incisor intrusion
External Apical Root Resorption need to be monitored during maximal incisor intrusion & retraction
- X-ray check every 3 months
- Stop forces for 3Ms if EARR noted
- Resume after lamina dura reappeared
- Finish orthodontic Tx anyway
- Patient communication
- Expenses for esthetic improvement
Etiology

- Supereruption of upper anteriors
- Vertical Maxilla Excess
- Short clinical crowns with attrition
- Altered passive eruption
- Short upper lip
- Hypermobility of upper lip
- Protrusion of upper anteriors
Gummy smile

- **Skeletal**
  - Vertical Maxillary Excess

- **Dentogingival**
  - Incisor supereruption
  - Altered passive eruption
  - Gingival hyperplasia

- **Muscular**
  - Short upper lip
  - Hypermobile upper lip
Treatment options

- Le Fort I impaction of $M_x$
- Intrusion of upper anteriors
- Periodontal surgery
- Botox
- Lip reposition
- V-Y Cheiloplasty
- Retraction of upper anteriors
Orthodontic Treatment to correct Gummy smile

- **Intrusion** of upper anteriors
- **Retraction** of upper anteriors
- **Periodontal surgery**
Retraction of anteriors

- Posterior TADs
- Infrazygomatic Crest for upper
- Buccal Shelf for lower
Posterior TADs not between roots

Infrazygomatic crest  Buccal Shelf
Placement of TADs outside the roots best chance for maximal retraction

12mm incisor retraction
5mm molar distalization
Intrusion of upper anteriors

- Anterior TADs
- Subapical placement
One more thing ...

How about the stability?
How about the stability?
How about the stability?
How about the stability?
How about the stability?
How about the stability?
How about the stability?
How about the stability?

As time and gravity are on our side, the long term stability seems to be promising for orthodontic correction of gummy smile.

Take home message

Maximal intrusion & retraction with TADs is a viable treatment option for gummy smile
Take home message

Posterior TADs *not* between roots
Take home message

Anterior TADs for bite opening and gummy smile correction
Exostosis after massive amount of incisor retraction
Orthodontic correction of Adult Gummy Smile with anterior miniscrew and Periodontal Surgery

Johnny JL Liaw

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Thank you for Attention!

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