How to treat open bite or upper anterior protrusion cases with *ankylosed teeth*

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Introduction

Interdisciplinary treatment

Review of Literatures

Open bite

Upper anterior protrusion

Summary

**Interdisciplinary Treatment**

- Impaction (ankyloses) of lower molars

Case 1  Case 2

1) If there is an erupting lower third molar, it may be recommended to extract the impacted first or second molar as one of options.

Case 1  Case 2

1) If there is an erupting lower third molar, it may be recommended to extract the impacted first or second molar as one of options.
2) If there is an erupting upper third molar, the extruded or malpositioned upper second molar may be extracted.
3) Regarding the interdisciplinary approach, oral surgeons should be realized the possibility of second molar extraction.
Review of Literatures

E-handout (open bite series lectures) are available at
1) 2013 https://www.aaoinfo.org/node/625
2) 2014 https://www.aaoinfo.org/node/2382
3) 2015 https://www.aaoinfo.org/node/4792

More questions are welcome taewoo@snu.ac.kr

Etiology of Open bite

There are several causes of open bite.

Open-bite cases look very similar. All of open bites have different causes.
Ankylosis or anchylosis (from Greek ἀγκύλος, bent, crooked) is a stiffness of a joint due to abnormal adhesion and rigidity of the bones of the joint, which may be the result of injury or disease.

(From Wikipedia, the free encyclopedia)

Traumatic injuries of the incisors cause several problems:

1. avulsion,
2. pulp necrosis,
3. crown fracture,
4. tooth discoloration,
5. external root resorption,
6. intrusion,
7. impaction, or
8. ankylosis.

The anterior openbite may be limited only to the ankylosed incisor or involve the whole anterior teeth.

Open bite caused by an ankylosed central incisor

Ankylosis is a common complication associated with the reimplantation of an avulsed maxillary incisor.

Ankylosis/replacement resorptions were observed in 21(42.9%) of 49 replanted teeth in Hecova’s retrospective study of 889 injured permanent teeth.

Diagnosis of Ankylosis

1. Ankylosis often can be identified by the metallic sound when percussing the teeth,
2. the lack of mobility,
3. the lack of periodontal space on the radiographic examination.
Diagnosis of Ankylosis

1. Ankylosis often can be identified by the metallic sound when percutting the teeth.

By using digital sound wave analysis, the ankylosed incisors will exhibit a higher proportion of their signal energy in high frequency bands, and this can be used for detection of the sound. But most of the time, the change in the percussion sound is hardly distinguishable.

2. Ankylosis often can be identified by the lack of mobility.

However, if the area of ankylosis is small or located on the buccal or lingual surface of the tooth, it is difficult to identify on a 2-dimensional radiograph.

3. Ankylosis often can be identified by the lack of periodontal space on the radiographic examination.

In addition, Periotest (Siemens/Medi-zintechnik-Guldén, Bensheim, Germany) can be used to assess tooth mobility. Ankylosed incisors have lower Periotest values. Unfortunately, clinical diagnosis of ankylosis, by mobility and percussion tests, is only reliable when at least 20% of the root surface is affected.

An ankylosed central incisor in a growing child

- fails to erupt and the alveolar process adjacent to the ankylosed tooth also fails to grow vertically, causing anterior open bite.

- This phenomenon was presented in many case reports.2,5-12

Diagnosis of Ankylosis through orthodontic force application as reported in several cases.5,7,11,16-18,25,30

A 21-year-old woman with a chief complaint of an anterior open bite. She had a history of facial trauma when she was 8 years old.

The patient’s chief complaint was a progressive anterior open bite. His maxillary right central incisor had been extrusively subluxated by trauma 1 year earlier.

CASE 1

Ankylosed central incisor (growing child) → Anterior open bite

CASE 2

Ankylosed central incisor (growing child) → Anterior open bite

CASE 5

Ankylosed central incisor (growing child) → Anterior open bite

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CASE 3

This case was a 16-year-old girl with an ankylosed maxillary left central incisor. When she was nine years old, this tooth was broken and treated endodontically.

CASE 4

A 9-year-old boy presented about 10 hours after losing his maxillary right central incisor as a result of facial trauma. The patient had brought his lost tooth, which was apparently undamaged. No sign of injury was detected on the soft tissues surrounding the empty socket. The tooth was replanted and splinted. The replanted tooth remained firmly in place and the surrounding soft tissues appeared healthy at the follow-up visits for 7 years, but a progressive infraocclusion.

CASE 5

The patient was first referred to our oral surgery clinic when she was 8 years 2 months old, after an accident in the swimming pool. Her traumatic injury included subluxation of a maxillary central incisor. The tooth was repositioned and stabilized with intramaxillary wire fixation. She returned to our clinic at age of 12 for orthodontic treatment. The injured incisor was ankylosed, and the radiograph showed apical root resorption of teeth, 11, 21 and 22.

CASE 6

The patient was 10 years old when orthodontic treatment began. She had a Class II Division 1 malocclusion with an overjet of 8 mm. The upper left central incisor had not completed eruption, and there was a history of trauma at age 5 to its predecessors.

CASE 3

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CASE 6

The patient was 10 years old when orthodontic treatment began. She had a Class II Division 1 malocclusion with an overjet of 8 mm. The upper left central incisor had not completed eruption, and there was a history of trauma at age 5 to its predecessors.
The patient was a girl, aged 11 years 11 months, who had bumped against the corner of a desk and damaged her maxillary incisors when she was 7 years old. The incisors were reimplanted, but the left central incisor eventually became ankylosed, preventing further growth of the alveolar bone, creating an open bite in the maxillary incisors.

CASE 7

Ankylosed central incisor (growing child) => Anterior open bite

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Ankylosed central incisor after growing finished.

• There was no anterior open bite. Usually, only the labially displaced incisor was traumatized and ankylosed.

• This phenomenon was presented in a case report.7

CASE 1

Ankylosed central incisor (after growing finished) => No anterior open bite

The patient was a 35-year-old woman.

Ankylosed central incisor after growing finished

No anterior open bite

Treatment modalities in growing children

• Resection18
• Spontaneous re-eruption15
• Decoronation20,21
• Extraction and substitution with the adjacent tooth22


Ankylosed central incisor (after growing finished)

No anterior open bite

CASE 2

Ankylosed central incisor (after growing finished) => No anterior open bite

51 years old man

CASE 749418

Recession

• In the past, an ankylosed permanent incisor was often surgically resected and replaced with a fixed or removable prosthetic tooth.18

A Caucasian female, aged 11 years and 5 months, was referred for orthodontic treatment of a marked Class II Div 1 malocclusion.

Spontaneous re-eruption

Within a few months using a partial multibracket appliance in the maxilla, the previously impalpable tooth could be extruded by several millimeters. But spontaneous re-eruption, after several years is an extremely rare finding.

Re-section

A long-term definitive restorative treatment using a single endosseous implant is planned. But a vertical alveolar defect makes an esthetic prosthetic replacement difficult and often results in a compromised esthetic outcome. In growing children the remaining vertical alveolar growth of adjacent teeth makes the treatment more difficult.

Spontaneous re-eruption

In 1991, a 7-year-old boy suffered a traumatic intrusion leading to an infra-position of tooth 21 along with its immobility. Based on the clinical findings, including bright-sounding percussion testing, disappearance of the periodontal space and a failed attempt at orthodontic movement, a diagnosis of ankylosis was made.

Spontaneous re-eruption

Material and Methods: Fifty-one intruded permanent incisors were studied in 20 boys and 19 girls, aged 6 to 17 years. Only three patients were over 12 years of age. Complete intrusion occurred in 21 teeth and 31 teeth were classified as immature. Re-eruption was awaited for 37 teeth. The remaining teeth were repositioned orthodontically (7 teeth) or surgically (7 teeth).

Results: Re-eruption occurred in 35 out of 37 teeth over a period of 3–12 months.
Spontaneous re-eruption

Results: After a mean observation period of 4 years ranging from 1–12 years, retained pulp vitality was recorded in 22 teeth (43%). Pulp necrosis had developed in 57%, inflammatory resorption in 26% and replacement resorption in 12%.

In the analysis all orthodontic and surgical repositioned teeth were combined into an active treatment group. The non-active treatment group consisted of teeth allowed to re-erupt. The distribution of replacement resorption was significantly lower in teeth allowed to re-erupt than in teeth repositioned actively.

Conclusions: The best treatment of intruded incisors in 6–12 year-old children is to await re-eruption. The time interval between trauma and complete re-eruption varied from 3 to 12 months with a mean of 5.6 months. Should endodontic treatment be required before re-eruption has occurred, a gingivectomy can be performed to gain access to the root canal.

Decoronation

Fig. 1. Intraoral occlusal view of the ankylosed right maxillary central incisor at the initial examination (12-year old).

Decoronation is a surgical method for treating ankylosed incisors in children and adolescents. Decoronation preserves not only the width of the ridge but also the vertical height.21

Fig. 2. Intraoral view of the wound edge approximation (over the decoronated ankylosed root) and suturing without tension.

Extraction and substitution with the adjacent tooth

A boy, aged 13 years 11 months.

He had a traumatic episode at age 11 years, and the maxillary left central incisor was avulsed. The tooth received endodontic treatment and was reimplanted.

The option of extracting the maxillary central incisors followed by space closure, with lateral incisors substituting for the central incisors, may be considered in some growing patients and also in adults.22

References:
Extraction of maxillary central incisors and mandibular first premolars because of crowding and protrusion.

Extraction of the maxillary central incisors is not a usual treatment protocol in orthodontics. However, in some patients with ankylosis of the maxillary central incisors and wide maxillary anterior teeth, this might be a good alternative to preserve tooth structure and avoid permanent prostheses as long as the patient's diagnostic characteristics will permit this plan.22

Extraction and substitution with its predecessor at age 5.

The patient was 10 years old when orthodontic treatment began. She had a Class II, Division 1 malocclusion with an overjet of 8 mm. The upper left central incisor had not completed eruption, and there was a history of trauma at age 5 to its predecessor.

The surgical luxation was performed with an elevator (301 type), and good mobilization was obtained. One day after this procedure, the coil spring was reactivated for 8 months with 50 gm of orthodontic force. However, instead of leveling the central incisor, the other teeth began intrusion and the bite opened.

Sufficient interdental space must exist so that a fine cut (osteotomy) can be made between adjacent teeth without injury to them.

Several surgical treatment protocols

1. Single tooth osteotomy8,16,23
2. Surgical luxation24-27
3. Corticotomy5
4. Distraction osteogenesis (DO)2,6,9-14,23,26,28

Single tooth osteotomy8,16,23

• move the dento-osseous segment into the desired position with adequately attached mucoperiosteal pedicles in order to maintain the blood supply to the tooth-bone segment

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Clinical aspect before surgical procedure.
Single tooth osteotomy

Schematic drawing showing soft tissue incisions slightly divergent and osteotomies parallel to each other (dashed lines).
With a thin osteotome, the cuts involving the medullary and the palatal bone were completed.

Immediate postoperative view after stabilization of segment.
After adequate mobilization, the segment was displaced inferiorly and attached to the arch wire.

Penial radiograph 8 months after procedure.
The dento-osseous segment was kept wired to the arch for 4 weeks.

The best time to perform this type of osteotomy would be after the facial growth has been completed. We had to consider that the tooth may not stay at the same level of the central incisor and this situation might require a crown restoration for elongation.

Surgical luxation

He had a dental history of trauma at age 10 years 2 months on the bilateral maxillary central incisors (teeth 11 and 21), the right maxillary and mandibular lateral incisors (teeth 12 and 42), and the right mandibular central incisor (tooth 41). Teeth 11 and 41 had suffered from crown fracture, and tooth 41 had been restored by composite resin bonding. Both teeth had been treated endodontically. Ankylosis was suspected on teeth 12 and 42, because of severe intrusive luxation (tooth 12) and replantation after traumatic avulsion (tooth 42). The intruded tooth 12 had been observed for a year after injury, and no spontaneous eruption had occurred.

Orthodontic forces were applied to teeth 12 and 42. A traction spring from the maxillary lingual arch was used to attempt eruption of tooth 12; after 3 months with no extrusive movement, a definitive diagnosis of ankylosis was made, and the surgical luxation was performed.

A periapical radiograph of tooth 42, taken after leveling, showed that the root filling material (calcium hydroxide) had disappeared, and replacement root resorption had occurred. Consequently, the application of orthodontic force was stopped immediately.
Distraction osteogenesis (DO)²,⁶,⁹-¹⁴,²³,²⁶,²⁸

**History**²

- The distraction osteogenesis technique was first successfully applied to long bones by Ilizarov in 1988,³¹ subsequently employed in the alveolar bone by Chin and Toth.³²

**Indication**²

- With a severely displaced (ankylosed) tooth, the tooth cannot be moved the entire distance necessary to reach the occlusal plane,
- because of the stretching limitations of the attached soft tissue during the surgery, additional undermining of the soft tissue was not an option because of the risk of interfering with the blood supply to the tooth and the alveolar segment.

**Three stages**³⁻¹

- Distraction osteogenesis consists of 3 sequential periods: latency, distraction, and consolidation.
  - Latency is the period from bone division to the onset of traction and is the time allowed for callus formation.
  - During the distraction period, gradual traction is applied, and new bone, or distraction regenerate, is formed.
  - The consolidation period allows maturation of the regenerate bone after the traction forces are discontinued.³¹

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Corticotomy⁵

Distraction osteogenesis (DO)2,6,9-14,23,26,28

The latency periods

• for the distraction of the dento-osseous block varied considerably for different case reports from 4 days,11 5 days,12,14 one week,2,10,13 and two weeks.14,28

• In most cases, after a latency period of one week, distraction of the dentoalveolar segment began.2,13

Distraction osteogenesis (DO)2,6,9-14,23,26,28

Rates of distraction

• For dento-alveolar distraction of a single tooth, various rates of distraction have been used previously from 0.5 mm to 1.0 mm per day.2,6,9-23,26,28

Distraction osteogenesis (DO)2,6,9-14,23,26,28

Advantages of using a distraction device

• Recently, many distractors have been invented and reported. The advantages of using a distraction device is that the displacement of the dento-alveolar block gradually increases in accurate amounts and the patient can extend the distractor at home.
Distraction osteogenesis

- Disadvantages of using a distraction device
  - Placing a distractor during surgery was a difficult task for the maxillofacial surgeon, because the distractor was unidirectional.
  - Furthermore, lengthening occurs only in a linear direction, with no possibility of 3-dimensional alignment of the osteotomized segment.
  - The secondary surgery to remove the distractor is the main disadvantage of the bone-borne distractor.

- Consolidation of the bone segment
  - The stability of the dento-osseous block after the distraction may be considered a key determinant in bone formation within the gap.\(^{35}\)
  - For consolidation of the bone segment, a passive heavy archwire has been left in place for 6 weeks,\(^2,28\) 12 weeks,\(^11\) or up to 5 months.\(^9\)

- Complication
  - In the review article by Saulacic et al regarding alveolar distraction osteogenesis, the most common complication was insufficient bone formation following the consolidation period (22 cases of 256 patients, 8%), followed by regression of distraction distance (18 cases, 7%).\(^{35}\) Incorrect design of the vertical osteotomy lines may also impede the movement of the transport segment.\(^{35}\)

\(^3\) Kinzinger et al reduced the consolidation period (only seventeen days of consolidation) to move the incisor into the final position by applying orthodontic forces early ("floating bone concept"), because the tooth was not moved to the desired position using the bone-borne distractor.\(^10\)
Distraction osteogenesis (DO)$^{2,6,9-14,23,26,28}$

- Complication
  - Because ankylosis-related *external replacement resorption* always led to complete root resorption,$^{9,19}$ it was notified to the patient and her parents that external resorption would be a complication leading eventually to tooth loss.
  - Although the ankylosed incisor will eventually be lost, the tooth can be used for several years with *conservation of alveolar bone*. Even if the root of the ankylosed tooth is progressively resorbed, our treatment could be an excellent way to prepare the site for *future implant treatment*.$^9$


The patient was first referred to our oral surgery clinic when she was 8 years 2 months old, after an accident in the swimming pool. Her traumatic injury included *subluxation* of a maxillary central incisor (#11) and fracture of the buccal processus alveolaris. The tooth was *repositioned* and stabilized with intraoral wire fixation. She returned to our clinic at age 12 for orthodontic treatment.

Distraction osteogenesis (DO)$^{2,6,9-14,23,26,28}$

- Bone-borne distraction devices$^{10}$

Several treatment alternatives were explored.
1. Perform a *conventional osteotomy* and augment the alveolar ridge vertically by removing autogenous bone or by using xenogenous materials. Secondary soft tissue surgery might be required later.
2. Extract the ankylosed tooth and replace it with an *implant* or a bridge.
3. Perform a segmental osteotomy with vertical callus *distraction* of the ankylosed tooth, using the floating bone concept; surgery would be preceded and followed by orthodontic treatment.

Option 3 was selected.


Distraction osteogenesis (DO)$^{2,6,9-14,23,26,28}$

- Bone-borne distraction devices$^{10}$

1. Preliminary orthodontic treatment with fixed appliances was initiated to create sufficient *intraradicular distance* in the projected region of the osteotomy.

Distraction osteogenesis (DO)$^{2,6,9-14,23,26,28}$

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Distraction osteogenesis (DO)$^{2,6,9-14,23,26,28}$

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After the segmental osteotomy, a single-tooth distractor (Gebrüder Martin GmbH & Co KG, Track 1.0, Tuttlingen, Germany) was placed surgically.

Distraction osteogenesis (DO)$^{2,6,9-14,23,26,28}$

- Bone-borne distraction devices$^{10}$

TREATMENT PROGRESS
**Distraction osteogenesis (DO)**<sup>2,6,9-14,23,26,28</sup>

- Bone-borne distraction devices<sup>10</sup>

**TREATMENT PROGRESS**

After a 7-day latency period, a distractor was applied to change the vertical incisor position, with activation during the 8-day distraction phase at a rate of 0.6 mm/day and a frequency of 2 activations/day (15 activations). The total distraction distance achieved was 4.5 mm.

Although sufficiently deep vertical adjustment of tooth 11 was obtained, there was clinically a marked palatal deviation.

The decision was then made to reduce the consolidation phase and, by using the floating bone effect, to move the tooth-supporting segment into the therapeutically desired position.

Seventeen days later, before final consolidation of the newly formed bone, the distractor was removed. During surgery, the tooth-supporting bone segment and the callus could be visualized from the vestibular aspect after removing the distractor.

Four days postoperatively, movement of the osteotomy segment into its final position was started by applying orthodontic forces and moments to the tooth in the segment. A bracket was bonded onto tooth 11 and, in addition to the passive bypass archwire, a superelastic 0.016x0.022-in copper-nickel-titanium segmented archwire was placed.

After only 18 days, 3-dimensional positioning of the tooth-supporting segment had been achieved with the floating bone effect, and the dental arch in the anterior region had been leveled sufficiently to allow a continuous 0.016x0.022-in stainless steel archwire to be placed for stabilization.
Distraction osteogenesis (DO)\textsuperscript{2,6,9-14,23,26,28}

- Bone-borne distraction devices\textsuperscript{10}

Posttreatment (retention period; 1.5 years later) intraoral photographs.

Distraction osteogenesis (DO)\textsuperscript{2,6,9-14,23,26,28}

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Distraction osteogenesis (DO)\textsuperscript{2,6,9-14,23,26,28}

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Disadvantages

3. Furthermore, lengthening occurs only in a linear direction, with no possibility of 3-dimensional alignment of the osteotomized segment.

4. Ready-made alveolar distractors are expensive and require a second surgery to remove the device.

Disadvantages

1. A clinical study by Krafft showed that in alveolar crest distraction, especially in the maxilla, the palatal mucosa followed the distraction to only a minor extent, thus producing a deviation of the distraction axis to the palatal.

2. Dental distractor during surgery thus becomes a difficult task for the maxillofacial surgeon because the intraorally applied distractor has a unidirectional impact.

Disadvantages

1. The callus could be visualized from the vestibular aspect after removing the distractor.

A clinical study by Krafft described a means of exerting a limited influence on the direction of the newly formed alveolar bone after removing the distractor: he found that the still soft, newly formed bone matrix could be slowly moved by applying firm, constant pressure with the finger. However, because the alveolar segment sprang back to the palatal after this manipulation, it had to be held buccally in the desired position with small metal plates. This procedure entails a longer retention phase and another surgery to remove the metal plates.

In addition, the mobilization period was brief. At the same time, 3-dimensional alignment of the tooth-supporting segment was completed quickly, with a multiband apparatus and appropriate biomechanics.
Distraction osteogenesis (DO)2,6,9-14,23,26,28

- Wire2

21-year-old woman with a chief complaint of an anterior open bite. She had a history of facial trauma when she was 8 years old. Her maxillary left lateral incisor was missing at that time. Avulsion of the maxillary right and left central incisors occurred from this trauma. These teeth were replanted and fixed with wire and resin.


A,B. Single-tooth dental-osseous osteotomy was performed under local anesthesia. C,D. Downward repositioning was attempted (an archwire was modified and placed in the bracket on the partially repositioned tooth, and the soft tissue was closed.

Another issue in distraction is the 3-dimensional problem of moving a dental-osseous segment. In this patient, the bony cuts were slightly divergent occlusally and facially, so the segment could be rotated to obtain adequate anterior labial root torque.

The maxillary left central incisor during the distraction osteogenesis:
A, 1 week after surgery
B, 2 weeks after surgery
C, 3 weeks after surgery
D, 5 weeks after surgery

The Posttreatment intraoral photographs

Distraction osteogenesis (DO)2,6,9-14,23,26,28

- Tooth-borne distraction devices6,11-14,23

Alcan T. A miniature tooth-borne distractor for the alignment of ankylosed teeth. Angle Orthod 2006;76:77-83.


Distraction osteogenesis (DO)\(^{2,6,9-14,23,26,28}\)

- Tooth-borne distraction devices\(^{6,11-14,23}\)

Kim Y, Park S, Son W, Kim S, Mah J.\(^{13}\)

Distraction osteogenesis (DO)\(^{2,6,9-14,23,26,28}\)

- SAS distraction devices\(^{13}\)

Im JJ, Kye MK, Hwang KG, Park CJ.\(^{13}\)

Distraction osteogenesis (DO)\(^{2,6,9-14,23,26,28}\)

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Razdolsky Y, El-Bialy TH, Dessner S, Buhler JE, Jr.\(^{14}\)

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- Tooth-borne distraction devices\textsuperscript{6,11-14,23}

Razdolsky Y, El-Bialy TH, Dessner S, Buhler JE, Jr.\textsuperscript{14}


Advantages

- No second surgery is required to remove the device.

Disadvantages

- Anchorage teeth were intruded.

Segmental osteotomies

Five days after surgery

Distractor activated 180° by patient three times per day with hex wrench.

After two weeks of distraction

Fixed appliances placed to stabilize incisor after removal of distractor.

After removal of fixed appliances.
Open bite

• Case 1

When ankylosis happens to a central incisor at a growing stage, alveolar bone around the tooth doesn’t grow vertically. After growing up, the patient presented anterior open bite.

Black arrow indicates the gingival margin. A pink resin was added to look like a gingiva and a tooth-colored resin was added incisal edge for camouflage by her dentist.

Pretreatment intraoral photos (18 years and 8 months old)

In the maxillary arch, MEAW (Multi-loop edgewise archwire, 018 x 0.022 stainless steel) was ligated. In the mandibular arch a .019 x .025 stainless steel archwire with shoe hooks was engaged. Class II elastics (5/16” 6oz) and up-and-down elastics (3/16” 6oz) were applied.

Progress intraoral photographs, 5 months after start of treatment (2008-11-28).

After open bite was resolved well except of the ankylosed incisor, two mini-implants were placed (1.6 x 6.0 mm mini-implant between #12 & #11 and # 22 & 23). On the maxillary upper left incisor, a new temporary crown was cemented over the ankylosed incisor for esthetics. Stainless steel wires (0.9 mm in diameter) were bonded for indirect anchorage.

Progress intraoral photographs, 12 months after start of treatment (2009-6-26).
Schematic drawing to explain the procedure

To keep the palatal mucosa intact for blood supply, only the labial bone was opened and osteotomy was done.

Seven days after osteotomy (2009-7-7)

The temporary crown was removed before surgery.

Distraction 3 days (2009-7-10)

A soft 0.020-in stainless steel surgical wire (Stainless Steel Soft Wire, HL-03309-3, Hanil Dental Ind. Co., Seoul, Korea) was distracted everyday.

Two small holes were made on the incisal resin of the crown to insert a surgical wire. By twisting and tightening the wire everyday, distraction was done.

Distraction 6 days (2009-7-15)

An average of 0.8 mm (0.5~1 mm) was distracted everyday.

Resin was removed from the incisal edge as the incisor was extruded.

Distraction 13 days (2009-7-21)

Distraction was stopped. The incisor was fixed to the archwire by bonding resin on the incisal edge for consolidation.

Distraction 13 days (2009-7-21)

Distraction was stopped. The incisor was fixed to the archwire by bonding resin on the incisal edge for consolidation.
Mini-implants were removed and a bracket was bonded on the maxillary left central incisor. In the mandibular arch, .019 x .025 TMA with a root lingual torque on a mandibular right central incisor.

Progress intraoral photographs, 1 year and 10 months after start of treatment (2010-4-14).

Posttreatment intraoral photographs (2010-7-21). 21 years old. 2 years and 1 month after start of treatment.

2013.8.30  
Post-retention  
3 years 1 month .

24 years and 1 month old. 3 years 1 month after debonding (2013.8.30).

Upper anterior protrusion

• Case 2  
When trauma happens to the protruded central incisors in a nongrowing persons, there will be no open bite.

2013.6.18 First visit  
Cervical abrasion was treated before starting orthodontic treatment.
2013.6.18 First visit

Lower third molars were extracted.

2014.5.2

At the initial leveling stage, #11 was diagnosed as ‘ankylosis’, because it was not moved at all. Spaces were gained for the osteotome.

2014.7.2 19 days after segmental osteotomy

6.13: Segmental osteotomy

2014.7.2 2014.7.5

Slight retraction of upper right central incisor.

2014.12.17

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Summary

• When the ankylosis happened during growth stage, it brought open bite. This open bite was treated with distraction osteogenesis.

• When the ankyloses was brought after growth finished and the distance of displacement is not great, segmental osteotomy, movement and fixation was used.

• Even after the consolidation, the position of tooth could be adjusted shortly by an arch wire, ‘Floating bone concept’.

• Interdisciplinary work with good oral surgeons understanding the direction & treatment plan of orthodontic treatment is recommended.