A New and Improved Indirect Bonding Technique

LARRY W. WHITE, DDS, MSD

Most orthodontists will agree that brackets can be positioned more accurately on study casts than directly on teeth in the mouth. Yet as recently as 1996, fewer than 10% of orthodontists routinely used an indirect bonding technique.[1] Reasons commonly given for not using the indirect method are the expense of the materials, the additional laboratory procedure, the necessity of training laboratory personnel, and the difficulty in achieving consistent and predictable adhesion to the teeth.

Most of the popular indirect bonding techniques require a matrix made from either a silicone impression material[2] or a vacuum-formed resin.[3] Over the past 20 years, I tried practically every method published, but I routinely failed to get the all the brackets to adhere to the teeth. Usually, two or three brackets would come out with the matrix when it was removed. It seemed to me that the matrices I used were not rigid enough to hold the brackets close against the teeth during composite polymerization. I am now convinced that this looseness or excessive flexibility is the major cause of bond failures with indirect techniques.

I have recently discovered a more rigid matrix material that still has enough elasticity and flexibility to permit easy removal after polymerization. The Surebonder DT-200 dual-temperature hot-glue gun* (Fig. 1) uses a polymer of ethylene vinyl acetate, which is FDA-approved and is non-toxic and non-carcinogenic. Such thermal glues are widely utilized in industry and home-building.

The inexpensive Surebonder works with mini-glue sticks, whose flow is easier to control than that from the larger sticks. In effect, the gun is simply a heating element that liquefies the solid glue stick and then places the glue where it is needed. Although the gun has a dual temperature control, the higher temperature tends to produce bubbles within the molten matrix; the lower temperature is hot enough for indirect bonding. The hot-glue matrix seldom fails to attach all the brackets to the teeth, and it has been much more reliable than any technique I have used.

Procedure

• Pour hard stone casts of both arches from either alginate or polyvinylsiloxane impression materials. Clean the models, and eliminate any defects. With a pencil, draw the axial midlines on the teeth to be bracketed (Fig. 2).

I use an Ormco bracket gauge** with lead

*FPC Corporation, 355 Hollow Hill Drive, Wauconda, IL 60084.

**Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.

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Fig. 1 Surebonder DT-200 dual-temperature hot-glue gun.

Fig. 2 Axial midlines drawn on teeth to be bracketed.

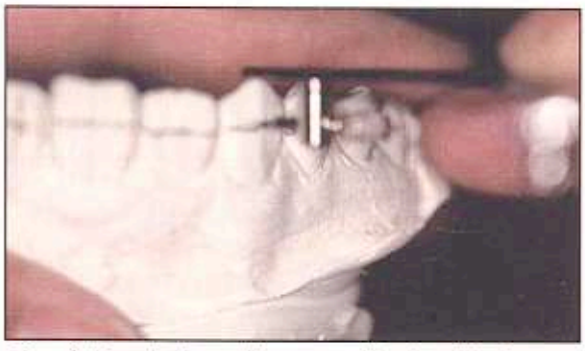

Fig. 3 Bracket positions scribed with Ormco bracket gauge.

points to scribe lines for the bracket positions (Fig. 3). Many recommended bracket slot heights have been published, but I prefer a slight modification of the ones suggested by Magness[1] (Table 1). These measurements must be varied according to the available crown heights, but the ratio of one bracket height to another will remain constant. More often than not, the second bicuspids will dictate the other bracket positions because of their delayed and limited eruption.

- After marking the teeth on the cast, apply two thin coats of separating liquid to all the tooth surfaces, and allow the separator to dry.
- The laboratory technician can now place the brackets on the casts with a small amount of Aleene's Tacky Glue,*** an inexpensive, water-soluble adhesive often used by hobbyists (Fig. 4). This glue sets quickly and must be manipulated immediately to properly position the brack-

***Aleene's, Buellton, CA.

TABLE 1
RECOMMENDED BRACKET SLOT HEIGHTS (MM)

	Maxillary	Mandibular
Central Incisor	4.00	4.00
Lateral Incisor	3.75	4.00
Cuspid	4.50	4.50
First Bicuspid	4.25	4.25
Second Bicuspid	4.00	4.00
First Molar	3.75	3.75
Second Molar	3.50	3.50

Fig. 4 Aleene's Tacky Glue.

et. The technician should check the height of each bracket with a bracket gauge as it is placed. The orthodontist, when reviewing the setup later, can quickly reposition any brackets with a small amount of fresh Tacky Glue (Fig. 5).

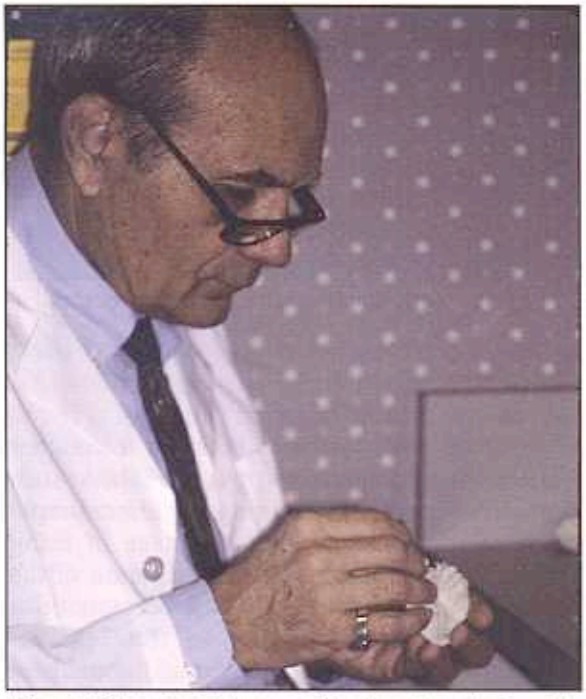

Fig. 5 Orthodontist repositioning brackets with fresh Tacky Glue.

Fig. 6 Glue gun used to form molten matrix over entire lingual and occlusal surfaces and part of facial surfaces of teeth and brackets, with care taken not to get glue in bracket slots.

- Spray the brackets with Pam (or a silicone spray) to lubricate their surfaces and make it easier to remove the matrix after composite polymerization.
- Use the glue gun to form a molten matrix over the entire lingual and occlusal surfaces and part of the facial surfaces of the teeth and brackets. The brackets should be covered only partially, with care taken not to get hot glue in the bracket slots; this will make it much more difficult to remove the matrix and does not add much to its stiffness (Fig. 6).

Before the hot glue sets, which takes only a few seconds, the technician should pat the molten glue into a close conformation, using a

Fig. 7 Using wet finger, technician pats molten glue into close conformation with teeth and brackets.

Fig. 8 Remaining glue brushed away with soft-bristle toothbrush and cold water.

Fig. 9 Border of matrix trimmed with scissor.

Fig. 10 Matrix stored on cast for quick reference to malocclusion.

finger that is kept wet, insulated, and lubricated by means of a nearby bowl of water (Fig. 7).

- After the glue cools and hardens, submerge the matrix and brackets in water for about 30 minutes to dissolve the Tacky Glue and separate the matrix and brackets from the cast. Soak the brackets and matrix for another hour or so; any remaining glue can then be easily brushed away with a soft-bristle toothbrush and cold water (Fig. 8).
- Trim off excess glue from the border of the matrix with a scissor (Fig. 9).

The hot-glue matrix has proven dimensionally stable and could probably be stored by itself, but I prefer to keep it with the cast for a quick reference to the malocclusion (Fig. 10).

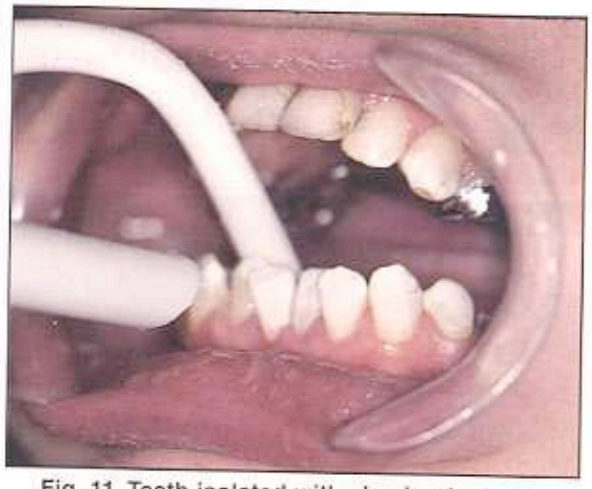

Fig. 11 Teeth isolated with cheek retractors.

Many of the popular bonding techniques require special treatments of the brackets, such as microetching, thermal curing, or surface preparation with chemicals. The advantage of using Tacky Glue is that no further preparation of the brackets is needed, either in the laboratory or at chairside. Nothing remains on the brackets except the original mesh, and no additional procedures are necessary other than adding the bonding composite.

Clinical Management

The water supplies in my area of the United States have high concentrations of fluoride, which makes composite bonding extremely unreliable. Fluorosed enamel often shows a minimal response to etching with 37% phosphoric acid. Microetching the enamel, using the technique first reported by Miller,[5] can increase the bondable surface area. Although microetching alone apparently has little clinical effect,[6] microetching followed by a chemical etch of phosphoric acid seems to greatly enlarge the bondable surface area of fluorosed enamel.

- After microetching, isolate the teeth in one arch. If the retractors are combined with triangular absorbent pads held against the cheeks and a

Fig. 12 Excel A and B filled composite pastes mixed on treated paper attached to frozen glass slab.

guard that keeps the tongue toward the back of the mouth, an antisialogogue will not be necessary (Fig. 11).

- Etch the teeth to be bonded for 20 seconds each with 37% phosphoric acid, then thoroughly rinse them with water and dry them with warm air.
- Mix two drops each of Excel† A and B unfilled sealant, and paint this mixture over the teeth.
- After attaching a small piece of treated paper to a frozen glass slab, mix equal amounts of Excel† A and B filled composite pastes (Fig. 12). The lower temperature slows the chemical curing of the composite and allows much more time for buttering the mixture over the bracket mesh with a toothpick (Fig. 13). When the matrix is placed in the mouth, however, the sudden temperature change accelerates the setting time.
- Seat the matrix and brackets on the teeth, applying only enough pressure to hold the matrix in place without distorting it. Hold the matrix for two minutes, then allow it to cure further while the other arch is bonded (Fig. 14). The same composite can be used for both arches if it is mixed at a reduced temperature.

Curing can be accelerated further by blowing warm air over the teeth and matrix (Fig. 15).

†Trademark of Reliance Corporation, P.O. Box 678, Itasca, IL 60143.

Fig. 13 Composite mixture spread over bracket mesh with toothpick.

Fig. 14 Hot-glue matrix and brackets held in place for two minutes.

Fig. 15 Curing accelerated with warm-air dryer.

Fig. 16 Matrix removed using small scaler with gentle prying motion.

Fig. 17 Composite light-cured through clear matrix.

The warm air has the additional benefit of softening the matrix, making it much easier to remove from around the bracket wings. Use a small scaler with a gentle prying motion (Fig. 16). There is seldom any flash of excess material, but any composite remaining between the teeth should be removed with dental floss.

The hot-glue technique has a particular appeal for those who use light-cured composites, since the clear matrix allows light to penetrate completely (Fig. 17). I usually apply the light for 40 seconds per tooth. Although light-curing takes more chairtime than is required for chemically cured composites, the new argon laser units reduce curing time to five seconds or less per tooth and permit the clinician to apply more direct pressure against each individual bracket[7] (Fig. 18).

Molars can be bonded with this method, but since they bear more occlusal pressure, their bonds often break. I ordinarily bond from bicuspid to bicuspid, insert a dead-soft introductory archwire, and then place separators for molar bands (Fig. 19). Separators should not be placed at the impression appointment, since they will move the teeth enough that the matrix will not fit. For the same reason, it is also better to delay

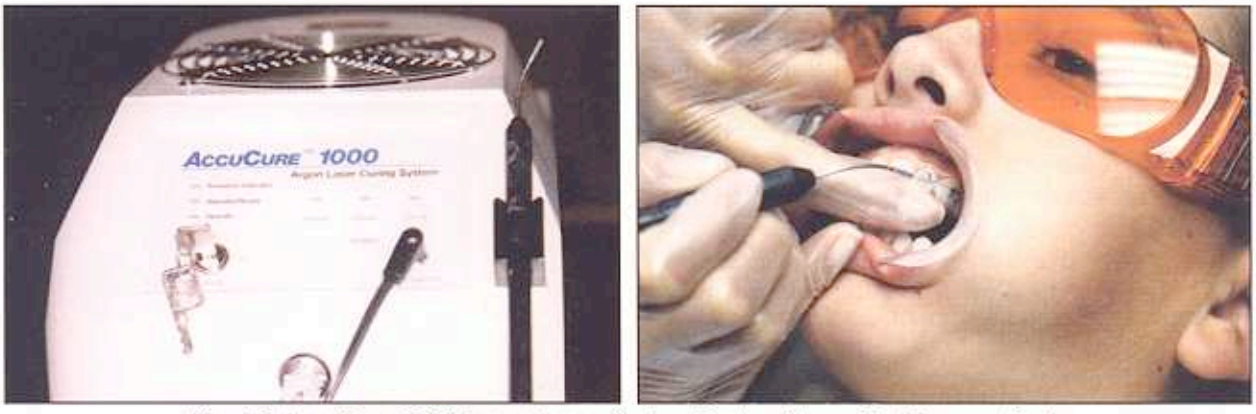

Fig. 18 AccuCure 1000 Argon Laser Curing System (LaserMed Corporation).

Fig. 19 Typical bicuspid-to-bicuspid initial archwire.

any extractions until later. A week or two after the bonding appointment, the patient returns for band cementation and placement of nickel titanium archwires.

Conclusion

The hot-glue matrix offers a reliable and inexpensive method for transferring accurately placed brackets to the teeth. Whereas the cost of materials for other methods using thermal-cure adhesives, polyvinylsiloxane impression materials, and filled bonding composites can approach $10 per patient, the Tacky Glue and hot glue together cost less than 10 cents per patient.

Nevertheless, the main advantage of this new indirect technique is its dependability. It is not a foolproof method, but with ordinary precautions, it is the most predictable indirect bonding system I have ever used.

The final proof of any clinical procedure is the enthusiasm of the people who work with it daily. In the past, there were only pessimistic moans when I announced a trial for a new indirect bonding method. Now, every assistant is quick to acclaim the improvement in bracket placement, the conservation of time, and the greater patient comfort we have achieved with this system. Returning to the old ways would invite a staff rebellion.

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A New Method of IZC placement of mini-screw to distalize the whole maxillary arch

[Abstract]: Distalization of the whole maxillary dentition has been always tried by many different kinds of mechanics in orthodontic history, but no direct efficient way of distalization yet. With the advancement of latest mini-screw system, the infrazygomatic crest (IZC) placement of the mini- screw not only provides excellent skeletal anchorage but also provides a whole new way of distalize the whole maxillary dentition in a much simpler way. In this article, the author described the new way of IZC placement and material properties of the screw in detail, and two clinical cases using IZC distalization were presented. With the new IZC placement of mini-screws the whole maxillary dentition can be distalized with simple and direct method. Two clinical cases using IZC distalization were presented.

[Key word]: stainless steel mini-screw, infrazygomatic crest (IZC), whole dentition distalization

The infrazygomatic crest (IZC) is an ideal site in the maxilla to place orthodontic mini-screws.

IZC is an area of cortical bone at the zygomatic process of the maxilla. It is a palpable bony ridge running along the curvature between the alveolar and zygomatic processes of the maxilla. In younger patients, it is located between the maxillary second premolar and first molar, whereas it is above the maxillary first molar in adults.

Liou's computed tomographic study [1] of the IZC placement of screw over the mesiobuccal root of the upper first molars suggested that insertion of mini-screw in the IZC for adults should be at the 14 to 26 mm above the maxillary occlusal plane and the maxillary first molar, and at an angle of 550 to 700 to the maxillary occlusal plane. (Fig.1)

The author followed the referenced guideline and used a 2 mm x12 mm stainless steel mini-screw. At first the mini-screw was inserted perpendicular to the bone surface to about 1 to 1.5 mm deep over the mucogingival junction around mesiobuccal root of the upper first molar. Then the author changed the mini-screw's direction at an angle of 550 to 700 to the maxillary occlusal plane before drilling the mini-screw into the IZC bone region. The strength and sharpness of the stainless steel mini-screw requires neither incision nor tissue punch. Self-drilling is sufficient. (Fig.2)

Clinically the author observes the IZC bone over the mesiobuccal root of upper first molars is quite thin in many cases. Recently cone beam CT images have shown that the buccal bone over the mesiobuccal root area of the upper second molar is much thicker than the buccal bone over the mesiobuccal root area of the upper first molars. Both a patient's CT (Fig.3) and a dry skull with part of the sinus wall removed (Fig.4) can confirm such a finding. The cone beam CT images study [2] of Chen also provided a favorable proof. So nowadays the author prefers to place mini-screw in the IZC area over the mesiobuccal root area of upper second molar, instead of first molar.

From a clinical case (Fig.5) we can see a 2mm x12mm stainless steel mini-screw was placed over IZC above the mesiobuccal root of upper second molar. The PA cephalogram showed the mini-screw was away from the root. From the panoramic radiograph it revealed the mini-screw was over the mesiobuccal root of upper second molar. The cone beam CT image suggested a 2mm x 12mm mini-screw made a good bicortical engagement. The tip of a mini-screw just penetrated about 1mm into the sinus. (Fig.5)

This is a case (Fig.6) that a 2mm x 10mm mini-screw was placed over the right upper edentulous area. After placing the IZC mini-screw, the patient complained about sinusitis on the right side and was diagnosed by an ENT doctor. The author suspected it was caused by the insertion of the screw. For a more thorough diagnosis, the author sent the patient to have a cone beam CT taken. The result showed the short 2mm x 10 mm mini-screw provided only mono cortical engagement, without touching the sinus wall at all. When tracing back the patient's past history, it turned out she has suffered chronic sinusitis. The latest sinusitis occurred simply coincided with the IZC placement of the mini-screw. From the panoramic view of the cone beam CT it clearly showed radiopaque shadow on the lower part of the right sinus. (Fig.6)

Regarding soft tissue, the author tries to limit the placement of the IZC mini-screw only over attached gingiva zone. On Fig.7, the zone of attached gingiva is quite narrow on the right buccal side of the case C. After placing the mini-screw, the head would almost touch the buccal tube, which made it impossible to distalize the whole upper dentition. The case A, B and the left buccal of the case C all have enough attached gingiva for the IZC placement of the mini-screw.

The upper case of Fig.8, a 16-year-and-3-month-old female came for treatment. Her soft tissue had enough attached gingiva, but the mini-screw became loose and failed in one week. The cone beam CT found out the sinus floor was very low. Even though it's a bicortical engagement, the engagement was only about 2~3mm on the solid bone wall. No wonder it failed. (upper Fig.8)

The lower case of Fig.8 was a 29-year-2-month-old male patient. A similar case of the same IZC mini-screw with only around 2~3mm bicortical engagement. However, the mini-screw stayed in place for more than 6 months and distalized the whole upper arch.

When comparing the two cases (Fig.8), it clearly showed that a bicortical engagement only needs 2~3mm on a mature adult bone. However, if the patient was young and the bone was not mature, then it'd be easily result in failure. These two cases also demonstrated that the perforation of sinus wall happened quite often. However, as long as the aseptic procedure was performed during screw placement, one should not worry about sinus perforation by the mini-screw. We can observe similar successful results from mini-plate fixation of the sinus wall on Le Fort I cases on the orthognathic surgery patients.

Even though we can place IZC mini-screw over mucosa easily, but it is usually not ideal in the long run. In this case (Fig.9) the mini-screw was placed over mucosa region. Two months later, soft tissue piled up due to the movable mucosa around the screw head. As time went on the screw head became totally embedded in the soft tissue and caused severe cellulites.

Sugawara's study [3] on the distalization of the whole upper arch showed the distal movement of the crown by 3.78mm and the root by 3.2mm with the use of min-plate system. Liaw's study [4] on the whole upper arch distalization revealed the distal movement of the crown by 2.8mm and the root by 1.4mm with the IZC placement of the mini-screw. Even though the amount of distalization seems less in the mini-screw group, clinically it is a very useful adjunct [5.6.7.8.9]. The mini-plates are not only more expensive but also involve quite a comprehensive surgery. Patients have to suffer from severe pain, swelling and a removal surgery afterwards. Comparing to mini-plate, the mini-screw is a very simple procedure. Orthodontists don't have to refer to other specialists to perform this easy and economical procedure. In conclusion the new IZC placement (over mesiobuccal root of upper second molars) is a very useful clinical adjunct.

Summary of the new IZC placement:

- It's outside of the root area. Unlike inter-radicular placement, the screw size has to be limited to 1.2mm~1.5mm in diameter [10]. Instead using a 2mmx12mm stainless mini-screw for bicortical engagement avoids root damage and caused almost no fracture of the screw.
- It can be as an excellent anchorage unit as inter-radicular placement of mini-screw.
- It's much better than inter-radicular placement of mini-screw for distalization of the whole upper arch.
- The 2mx12mm stainless steel mini-screw requires neither incision nor tissue punch. Self-drilling is sufficient.
- IZC placement over mesiobuccal root area of upper second molar is better than over that of the upper first molars.
- Better be placed over the attached gingiva area.
- Contra indicated for patients of a very young age and with low sinus floor among the roots of maxillary molars.
- Using about 10~12oz (or 284-340 gm) to distalize the whole upper arch. An excessive force will result in failure!

Cases Report

Case A

A 17 years old female patient, complained procumbent upper incisors, protruded upper lip and lip incompetence. Lt side Class II, right side Class I, with big overjet and lower midline deviate to left side. Patient's chin point deviate to left, but patient's main concern is protruded upper lip and insists on nonextraction treatment. Damon system brackets were used, and the whole upper arch was distalized. Class I occlusion with dental midline on and good facial profile achieved. The facial asymmetries still the same as beginning, but patient doesn't care.

Fig 10

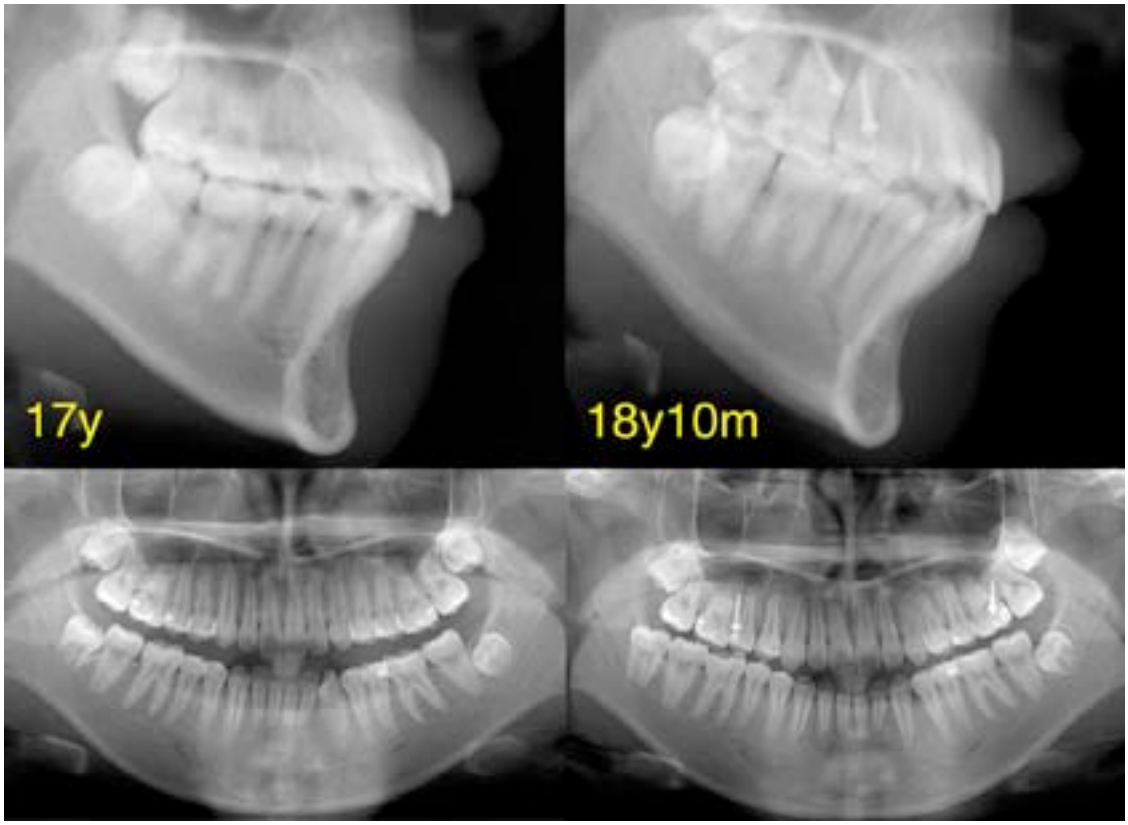
A Class II subdivision case was treated with whole maxillary arch distalization.

17y5m: After 4 months Damon alignment, the teeth well aligned, but overjet is big. Put 2 2mm x 12mm stainless steel mini-screws over IZC area around mesial buccal root of upper second molars.

17y11m: After 6 months of whole upper arch distalization, left side molar Class I, and almost edge to edge occlusion.

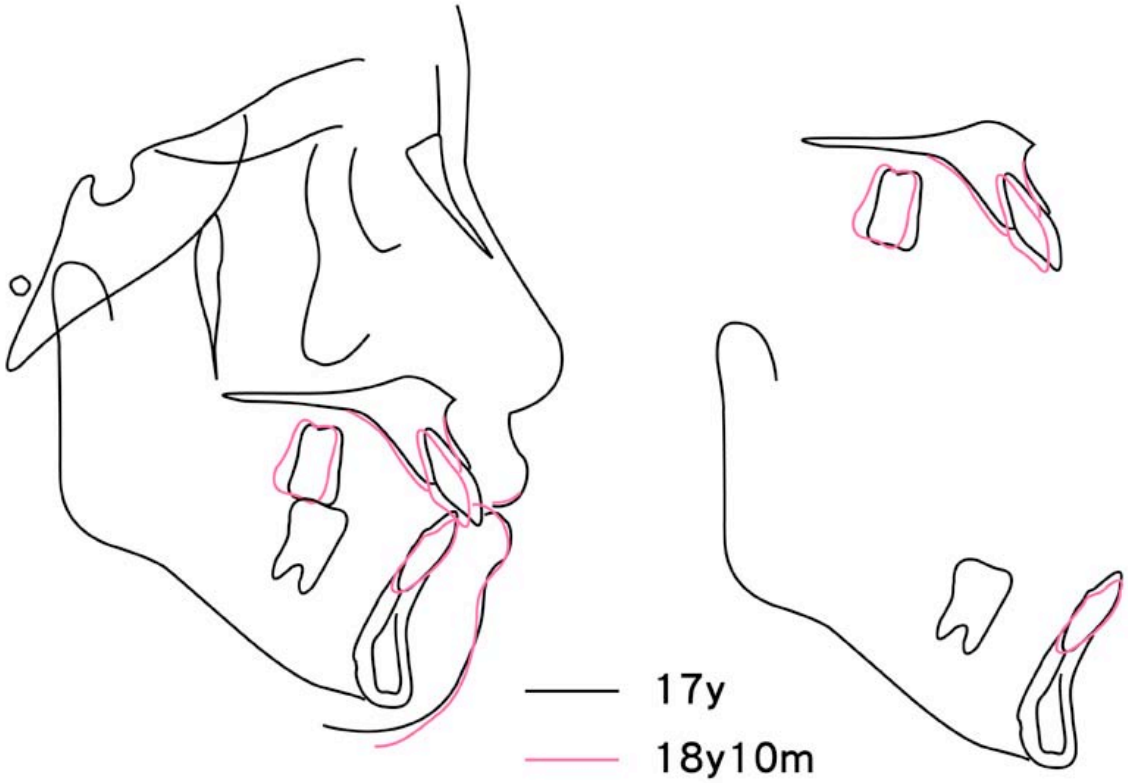
18y10m: After 1 year 10 months treatment, both side first molars in super Class I occlusion, with shallow anterior overbite, the protruded upper lip corrected to good lip profile.

Fig 11



Case A, from the cephalogram showed big reduction of the overjet. Panorex showed healthy dentition without noticeable root resorption. Watch the upper dentition was distalized with upper 3rd molars present.

Fig 12



Case A, Ceph superimposition showed the upper dentition distalized. Overjet reduced.

Case B

A 20 years 2 months old female patient, chief complaint: procumbent upper incisors and lip incompetence.

Right side with Class I occlusion, left side with Class II, lower anterior teeth minor crowding. The profile shows upper lip protrusion, acute nasolabial angle and lip incompetence, for preventing dish-in face after four bicuspid extractions, nonextraction treatment was preceded. With the mini-screw placed over buccal side of upper first molar region and the whole upper arch was distalized, establish Class I occlusion and normal overbite, overjet and good balanced profile.

Fig. 13

A Class II subdivision case was treated with whole maxillary arch distalization.

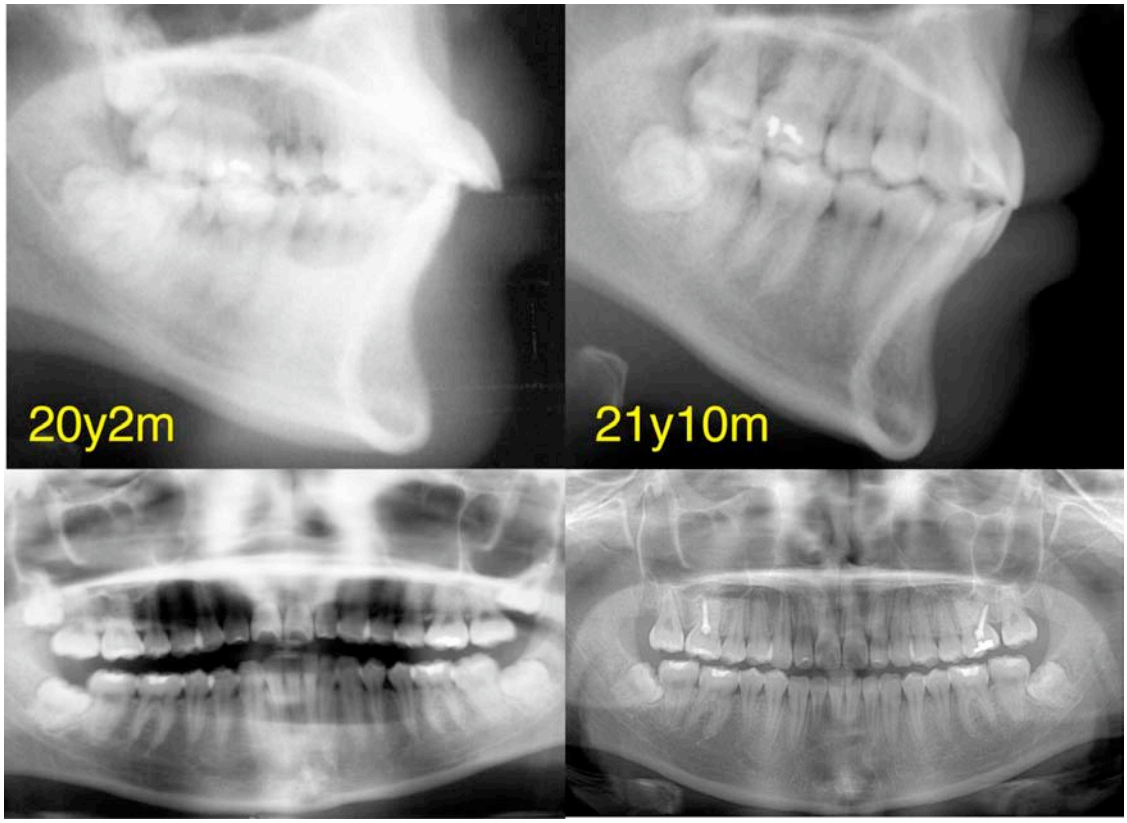
20y5m: Two 2mm x 12mm mini-screws were placed over IZC area.

20y11m: After 6 months whole arch distalization, both side achieved Class I.

21y10m: After 1 year 8 months treatment, achieved Class I and edge to edge bite, good profile.

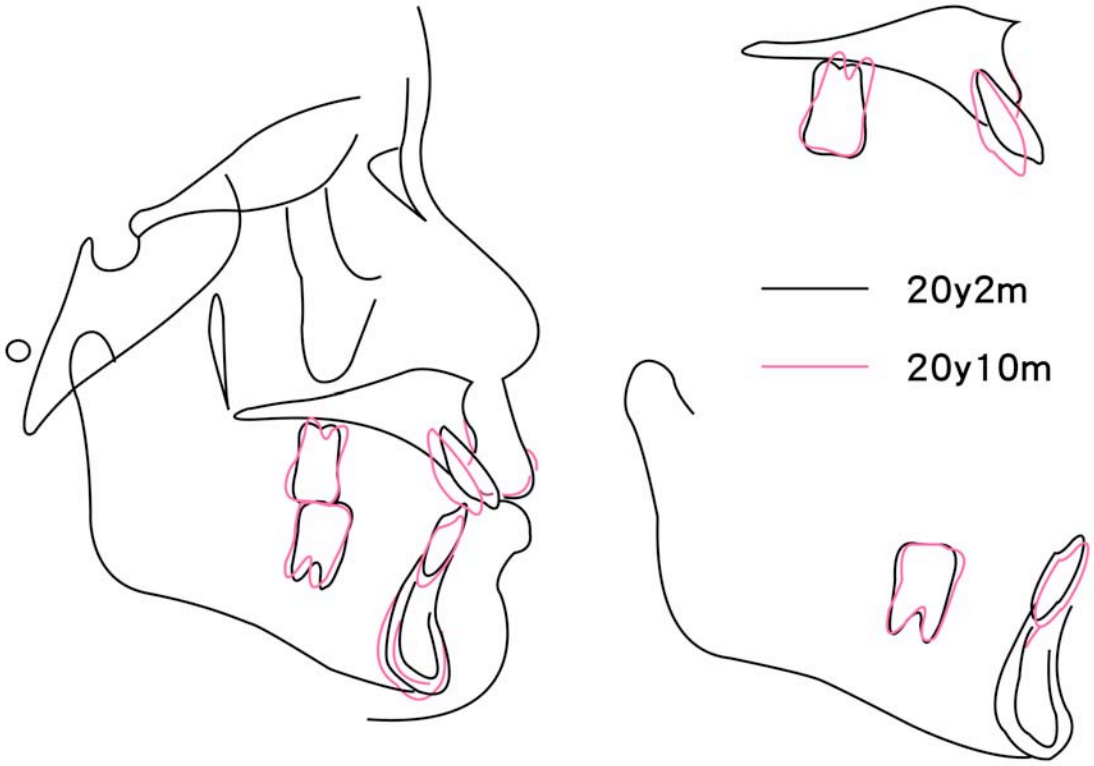
22y9m: After 11 months retention, the over corrected edge to edge become normal overbite and overjet, maintains good facial profile.

Fig 14



Case B, from the cephalogram, clearly shows reduction of big overjet by upper arch distalization, post treatment panorex showed healthy periodontal and apical dental structure.

Fig 15



Case B, before and after distalization of the whole upper arch shows dramatic reduction of the overjet.

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Fig 1

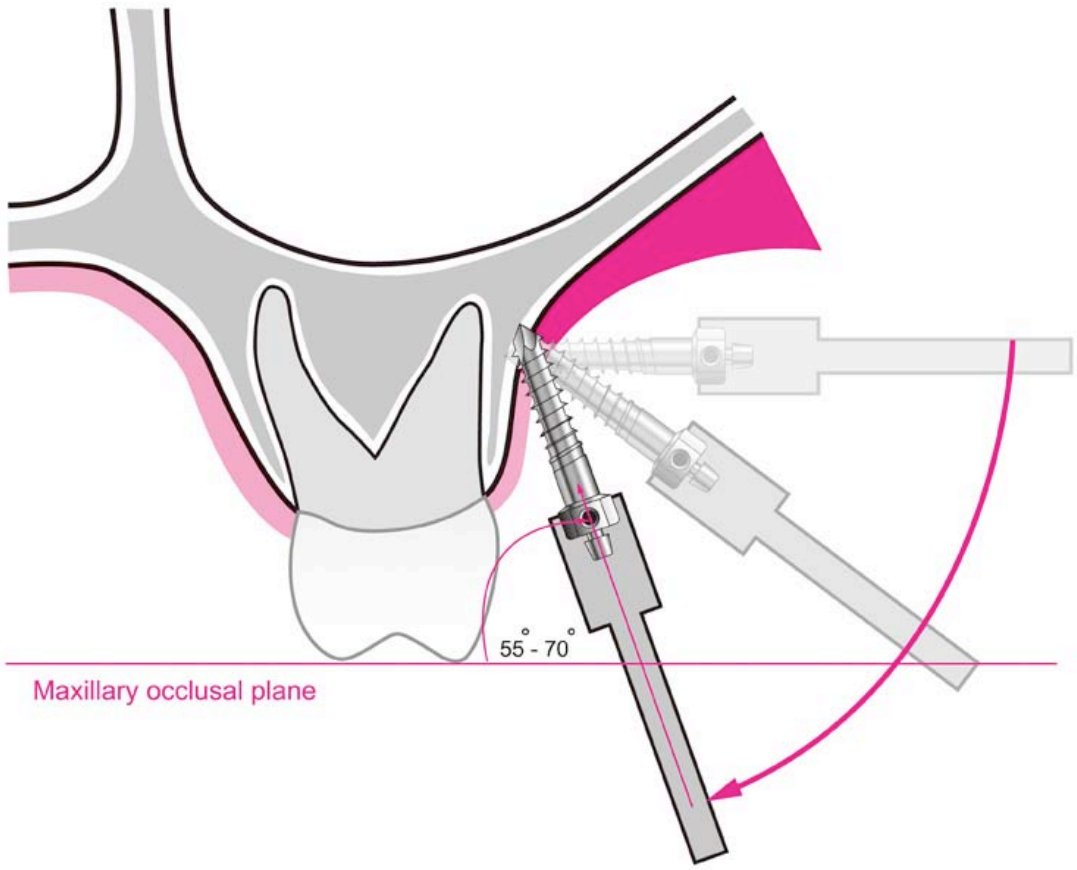
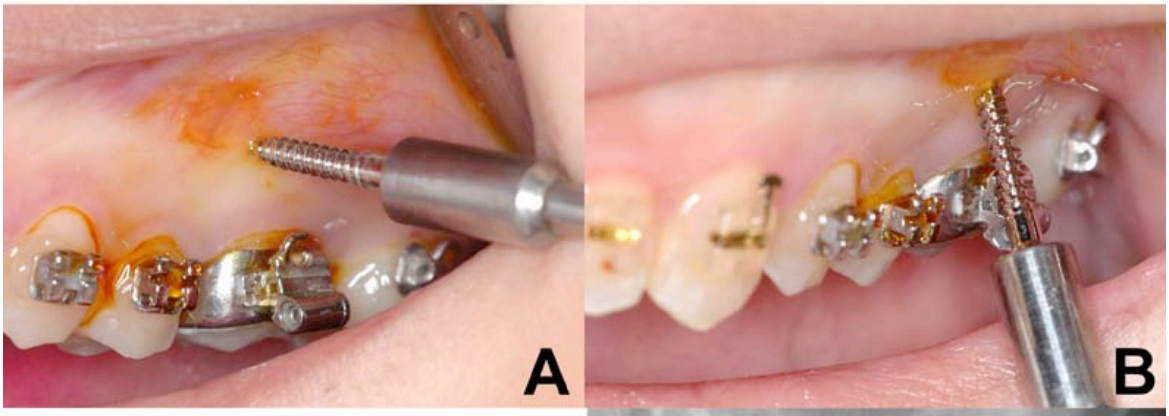


Fig 2



No incision
No tissue punch
No pre-drilling
Self-drilling

Fig 3

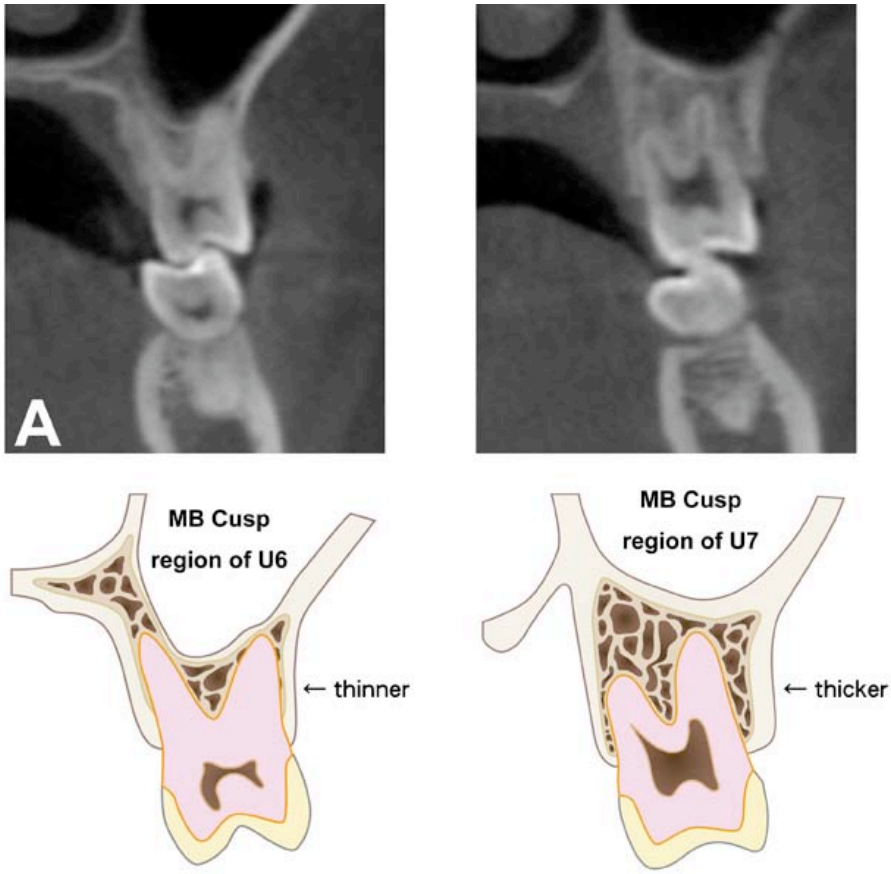
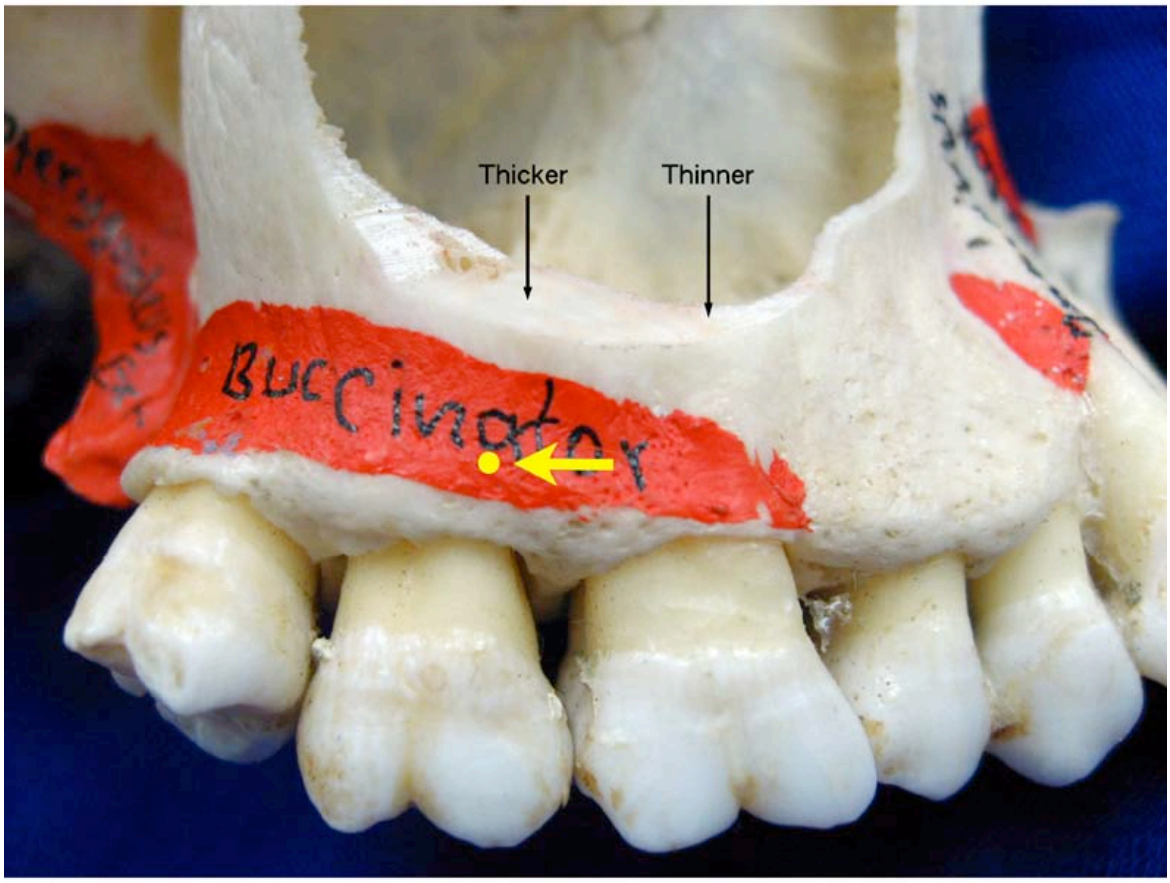

A
MB Cusp
region of U6
← thinner
MB Cusp
region of U7
← thicker

Fig 4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Thinner
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Fig 5

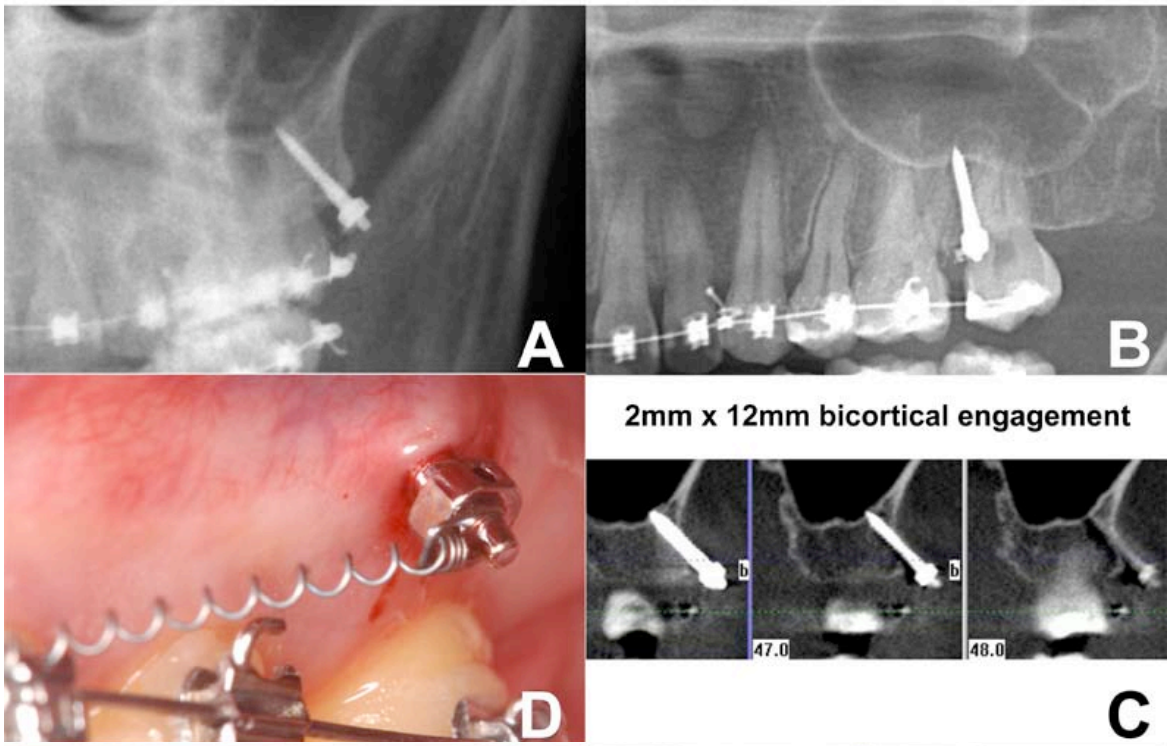

A
B
2mm x 12mm bicortical engagement
47.0
48.0
C
D

Fig 6

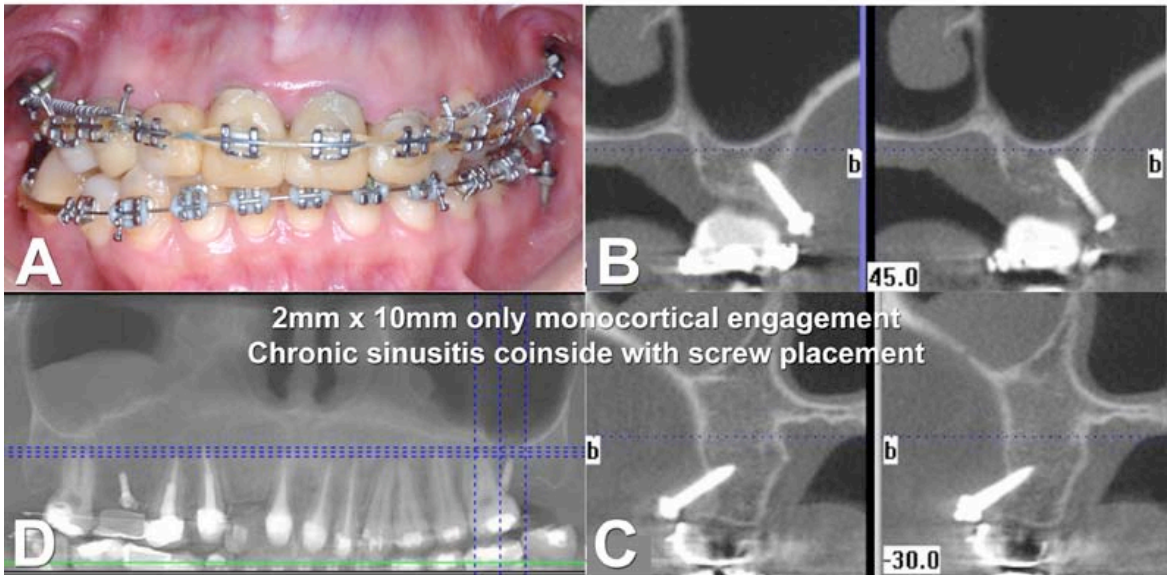

A
B
45.0
2mm x 10mm only monocortical engagement
Chronic sinusitis coinside with screw placement
D
C
-30.0

Fig 7


A
B
Narrow zone of attached gingiva mucogingival sinution
CR
CL

Fig 8

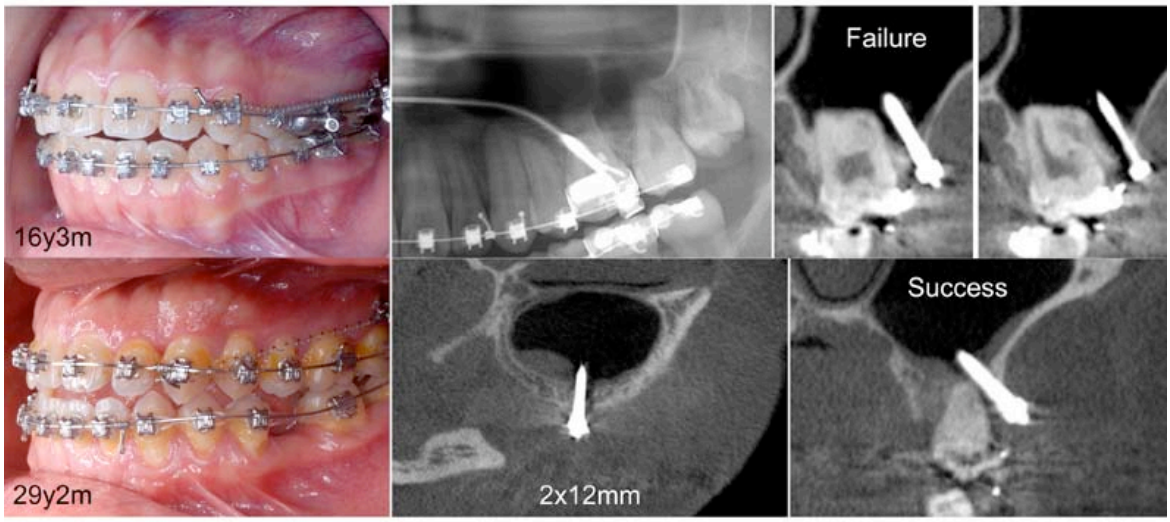
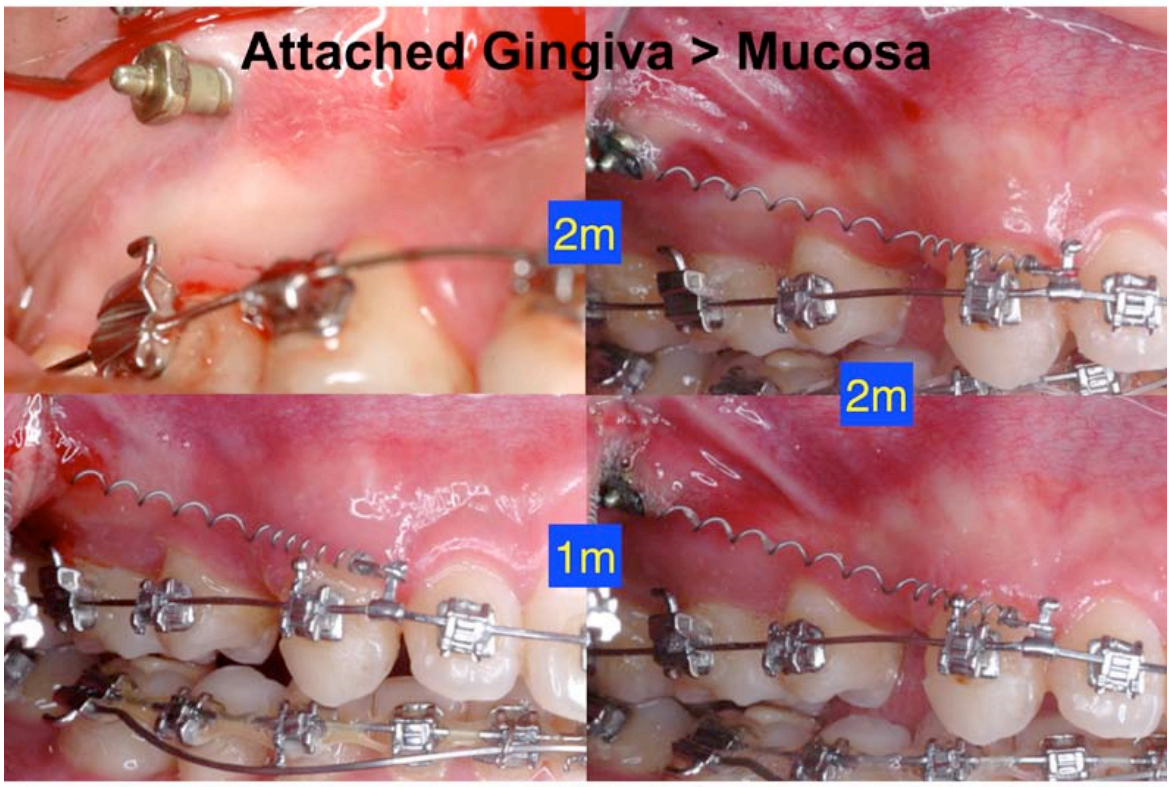

16y3m
Failure
29y2m
2x12mm
Success

Fig 9



A New Method of IZC placement of mini-screw to distalize the whole maxillary arch

[Abstract]: Distalization of the whole maxillary dentition has been always tried by many different kinds of mechanics in orthodontic history, but no direct efficient way of distalization yet. With the advancement of latest mini-screw system, the infrazygomatic crest (IZC) placement of the mini- screw not only provides excellent skeletal anchorage but also provides a whole new way of distalize the whole maxillary dentition in a much simpler way. In this article, the author described the new way of IZC placement and material properties of the screw in detail, and two clinical cases using IZC distalization were presented. With the new IZC placement of mini-screws the whole maxillary dentition can be distalized with simple and direct method. Two clinical cases using IZC distalization were presented.

[Key word]: stainless steel mini-screw, infrazygomatic crest (IZC), whole dentition distalization

The infrazygomatic crest (IZC) is an ideal site in the maxilla to place orthodontic mini-screws.

IZC is an area of cortical bone at the zygomatic process of the maxilla. It is a palpable bony ridge running along the curvature between the alveolar and zygomatic processes of the maxilla. In younger patients, it is located between the maxillary second premolar and first molar, whereas it is above the maxillary first molar in adults.

Liou's computed tomographic study [1] of the IZC placement of screw over the mesiobuccal root of the upper first molars suggested that insertion of mini-screw in the IZC for adults should be at the 14 to 26 mm above the maxillary occlusal plane and the maxillary first molar, and at an angle of 550 to 700 to the maxillary occlusal plane. (Fig.1)

The author followed the referenced guideline and used a 2 mm x12 mm stainless steel mini-screw. At first the mini-screw was inserted perpendicular to the bone surface to about 1 to 1.5 mm deep over the mucogingival junction around mesiobuccal root of the upper first molar. Then the author changed the mini-screw's direction at an angle of 550 to 700 to the maxillary occlusal plane before drilling the mini-screw into the IZC bone region. The strength and sharpness of the stainless steel mini-screw requires neither incision nor tissue punch. Self-drilling is sufficient. (Fig.2)

Clinically the author observes the IZC bone over the mesiobuccal root of upper first molars is quite thin in many cases. Recently cone beam CT images have shown that the buccal bone over the mesiobuccal root area of the upper second molar is much thicker than the buccal bone over the mesiobuccal root area of the upper first molars. Both a patient's CT (Fig.3) and a dry skull with part of the sinus wall removed (Fig.4) can confirm such a finding. The cone beam CT images study [2] of Chen also provided a favorable proof. So nowadays the author prefers to place mini-screw in the IZC area over the mesiobuccal root area of upper second molar, instead of first molar.

From a clinical case (Fig.5) we can see a 2mm x12mm stainless steel mini-screw was placed over IZC above the mesiobuccal root of upper second molar. The PA cephalogram showed the mini-screw was away from the root. From the panoramic radiograph it revealed the mini-screw was over the mesiobuccal root of upper second molar. The cone beam CT image suggested a 2mm x 12mm mini-screw made a good bicortical engagement. The tip of a mini-screw just penetrated about 1mm into the sinus. (Fig.5)

This is a case (Fig.6) that a 2mm x 10mm mini-screw was placed over the right upper edentulous area. After placing the IZC mini-screw, the patient complained about sinusitis on the right side and was diagnosed by an ENT doctor. The author suspected it was caused by the insertion of the screw. For a more thorough diagnosis, the author sent the patient to have a cone beam CT taken. The result showed the short 2mm x 10 mm mini-screw provided only mono cortical engagement, without touching the sinus wall at all. When tracing back the patient's past history, it turned out she has suffered chronic sinusitis. The latest sinusitis occurred simply coincided with the IZC placement of the mini-screw. From the panoramic view of the cone beam CT it clearly showed radiopaque shadow on the lower part of the right sinus. (Fig.6)

Regarding soft tissue, the author tries to limit the placement of the IZC mini-screw only over attached gingiva zone. On Fig.7, the zone of attached gingiva is quite narrow on the right buccal side of the case C. After placing the mini-screw, the head would almost touch the buccal tube, which made it impossible to distalize the whole upper dentition. The case A, B and the left buccal of the case C all have enough attached gingiva for the IZC placement of the mini-screw.

The upper case of Fig.8, a 16-year-and-3-month-old female came for treatment. Her soft tissue had enough attached gingiva, but the mini-screw became loose and failed in one week. The cone beam CT found out the sinus floor was very low. Even though it's a bicortical engagement, the engagement was only about 2~3mm on the solid bone wall. No wonder it failed. (upper Fig.8)

The lower case of Fig.8 was a 29-year-2-month-old male patient. A similar case of the same IZC mini-screw with only around 2~3mm bicortical engagement. However, the mini-screw stayed in place for more than 6 months and distalized the whole upper arch.

When comparing the two cases (Fig.8), it clearly showed that a bicortical engagement only needs 2~3mm on a mature adult bone. However, if the patient was young and the bone was not mature, then it'd be easily result in failure. These two cases also demonstrated that the perforation of sinus wall happened quite often. However, as long as the aseptic procedure was performed during screw placement, one should not worry about sinus perforation by the mini-screw. We can observe similar successful results from mini-plate fixation of the sinus wall on Le Fort I cases on the orthognathic surgery patients.

Even though we can place IZC mini-screw over mucosa easily, but it is usually not ideal in the long run. In this case (Fig.9) the mini-screw was placed over mucosa region. Two months later, soft tissue piled up due to the movable mucosa around the screw head. As time went on the screw head became totally embedded in the soft tissue and caused severe cellulites.

Sugawara's study [3] on the distalization of the whole upper arch showed the distal movement of the crown by 3.78mm and the root by 3.2mm with the use of min-plate system. Liaw's study [4] on the whole upper arch distalization revealed the distal movement of the crown by 2.8mm and the root by 1.4mm with the IZC placement of the mini-screw. Even though the amount of distalization seems less in the mini-screw group, clinically it is a very useful adjunct [5.6.7.8.9]. The mini-plates are not only more expensive but also involve quite a comprehensive surgery. Patients have to suffer from severe pain, swelling and a removal surgery afterwards. Comparing to mini-plate, the mini-screw is a very simple procedure. Orthodontists don't have to refer to other specialists to perform this easy and economical procedure. In conclusion the new IZC placement (over mesiobuccal root of upper second molars) is a very useful clinical adjunct.

Summary of the new IZC placement:

- It's outside of the root area. Unlike inter-radicular placement, the screw size has to be limited to 1.2mm~1.5mm in diameter [10]. Instead using a 2mmx12mm stainless mini-screw for bicortical engagement avoids root damage and caused almost no fracture of the screw.
- It can be as an excellent anchorage unit as inter-radicular placement of mini-screw.
- It's much better than inter-radicular placement of mini-screw for distalization of the whole upper arch.
- The 2mx12mm stainless steel mini-screw requires neither incision nor tissue punch. Self-drilling is sufficient.
- IZC placement over mesiobuccal root area of upper second molar is better than over that of the upper first molars.
- Better be placed over the attached gingiva area.
- Contra indicated for patients of a very young age and with low sinus floor among the roots of maxillary molars.
- Using about 10~12oz (or 284-340 gm) to distalize the whole upper arch. An excessive force will result in failure!

Cases Report

Case A

A 17 years old female patient, complained procumbent upper incisors, protruded upper lip and lip incompetence. Lt side Class II, right side Class I, with big overjet and lower midline deviate to left side. Patient's chin point deviate to left, but patient's main concern is protruded upper lip and insists on nonextraction treatment. Damon system brackets were used, and the whole upper arch was distalized. Class I occlusion with dental midline on and good facial profile achieved. The facial asymmetries still the same as beginning, but patient doesn't care.

Fig 10

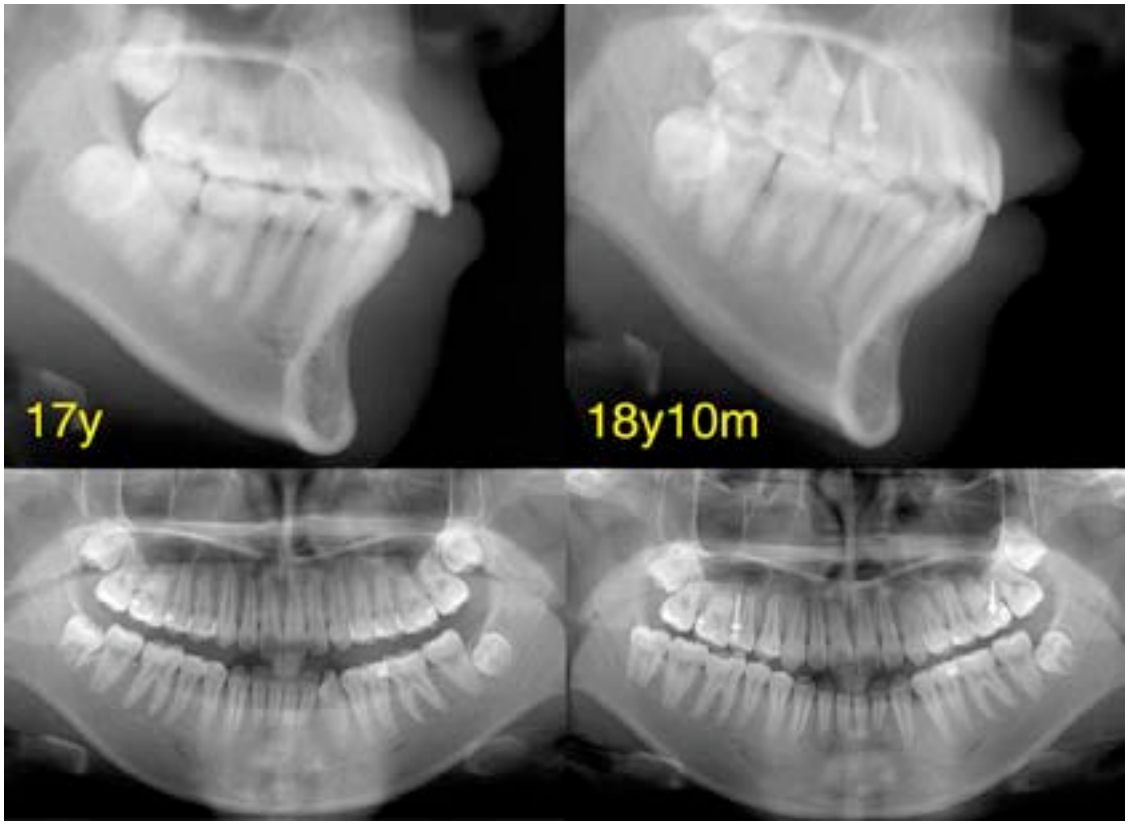
A Class II subdivision case was treated with whole maxillary arch distalization.

17y5m: After 4 months Damon alignment, the teeth well aligned, but overjet is big. Put 2 2mm x 12mm stainless steel mini-screws over IZC area around mesial buccal root of upper second molars.

17y11m: After 6 months of whole upper arch distalization, left side molar Class I, and almost edge to edge occlusion.

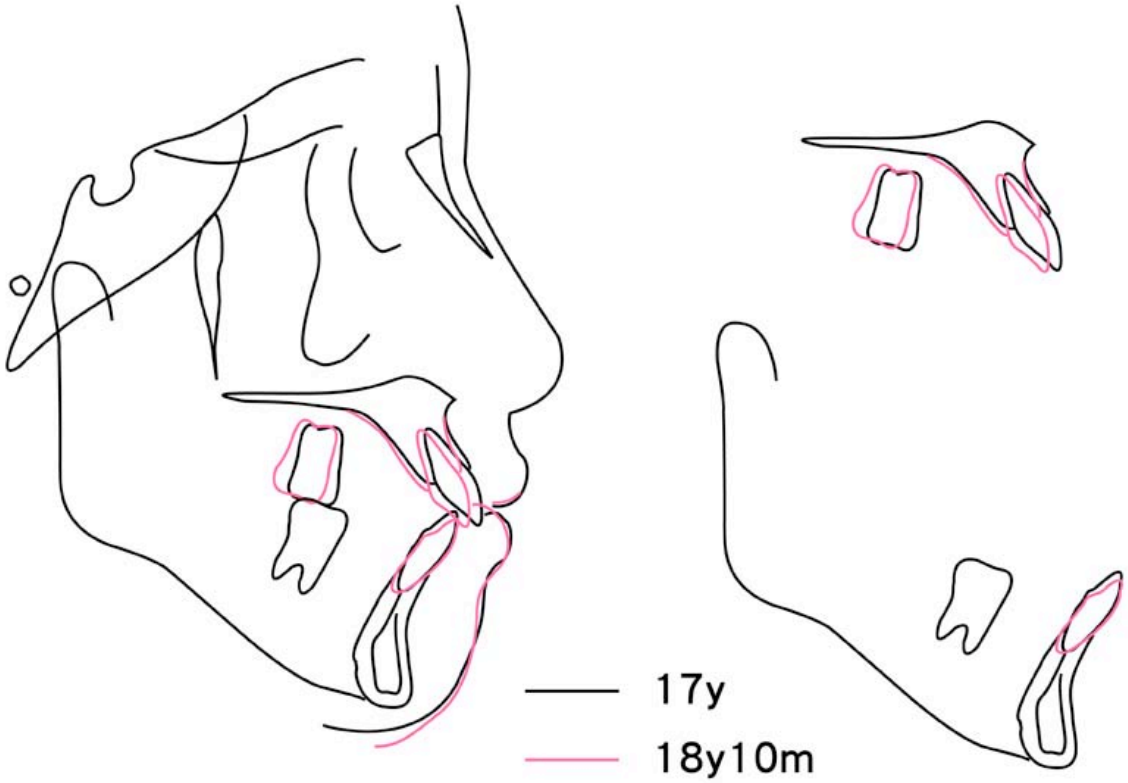
18y10m: After 1 year 10 months treatment, both side first molars in super Class I occlusion, with shallow anterior overbite, the protruded upper lip corrected to good lip profile.

Fig 11



Case A, from the cephalogram showed big reduction of the overjet. Panorex showed healthy dentition without noticeable root resorption. Watch the upper dentition was distalized with upper 3rd molars present.

Fig 12



Case A, Ceph superimposition showed the upper dentition distalized. Overjet reduced.

Case B

A 20 years 2 months old female patient, chief complaint: procumbent upper incisors and lip incompetence.

Right side with Class I occlusion, left side with Class II, lower anterior teeth minor crowding. The profile shows upper lip protrusion, acute nasolabial angle and lip incompetence, for preventing dish-in face after four bicuspid extractions, nonextraction treatment was preceded. With the mini-screw placed over buccal side of upper first molar region and the whole upper arch was distalized, establish Class I occlusion and normal overbite, overjet and good balanced profile.

Fig. 13

A Class II subdivision case was treated with whole maxillary arch distalization.

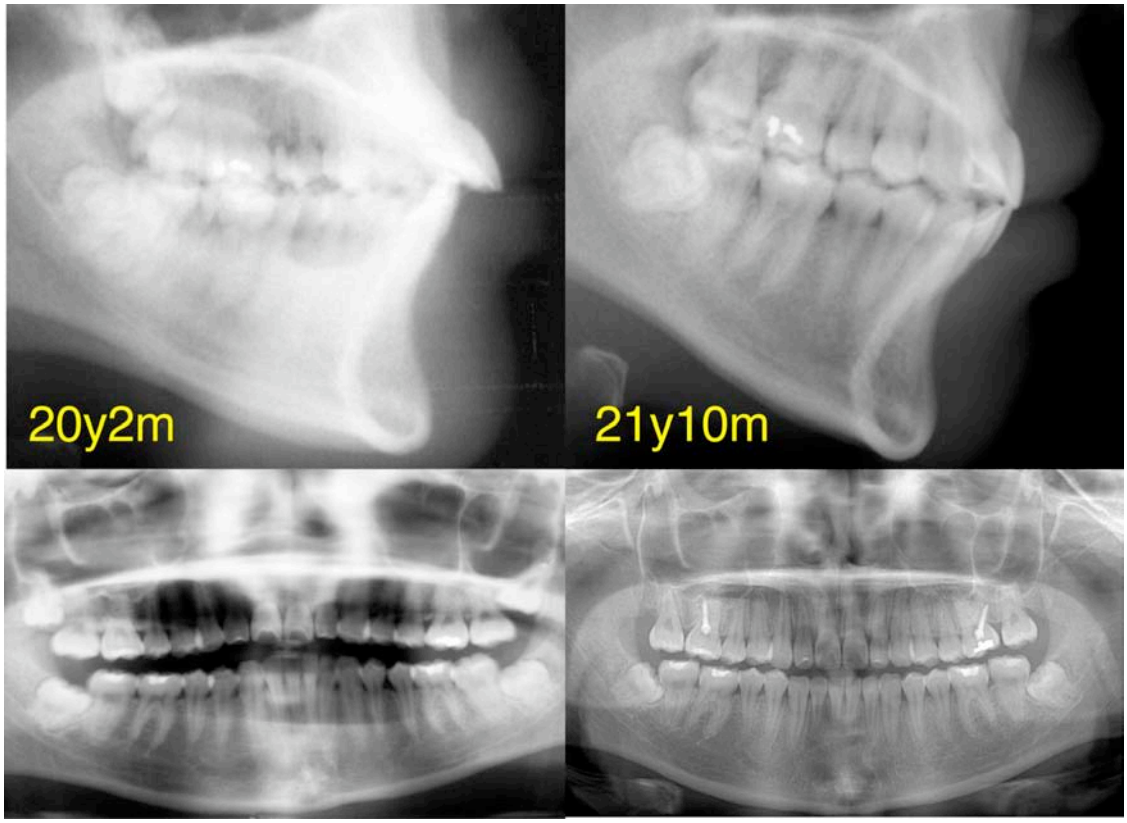
20y5m: Two 2mm x 12mm mini-screws were placed over IZC area.

20y11m: After 6 months whole arch distalization, both side achieved Class I.

21y10m: After 1 year 8 months treatment, achieved Class I and edge to edge bite, good profile.

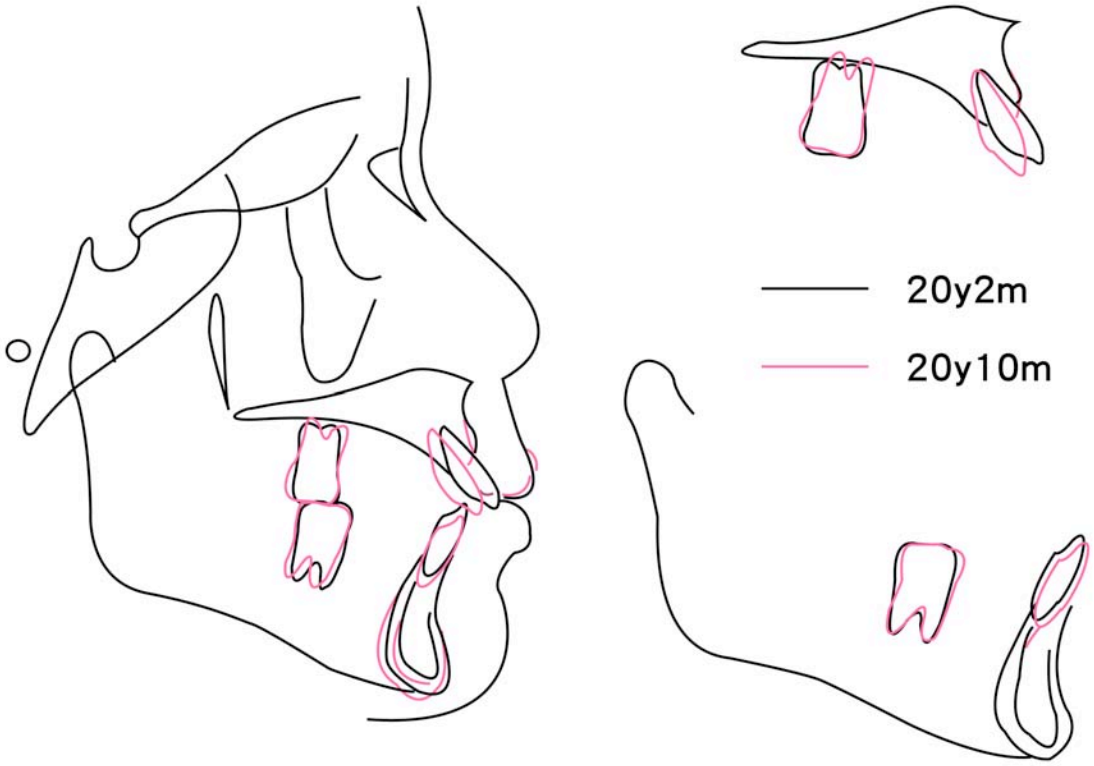
22y9m: After 11 months retention, the over corrected edge to edge become normal overbite and overjet, maintains good facial profile.

Fig 14



Case B, from the cephalogram, clearly shows reduction of big overjet by upper arch distalization, post treatment panorex showed healthy periodontal and apical dental structure.

Fig 15



Case B, before and after distalization of the whole upper arch shows dramatic reduction of the overjet.

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Fig 1

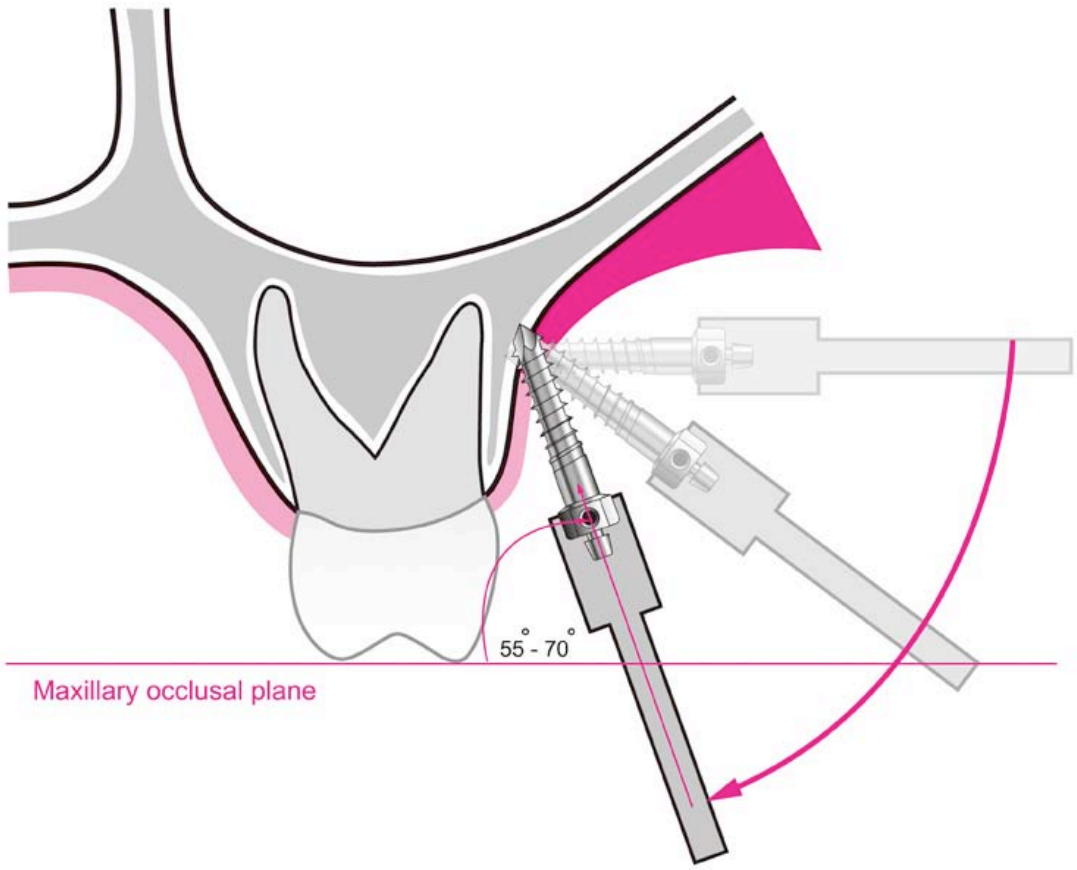
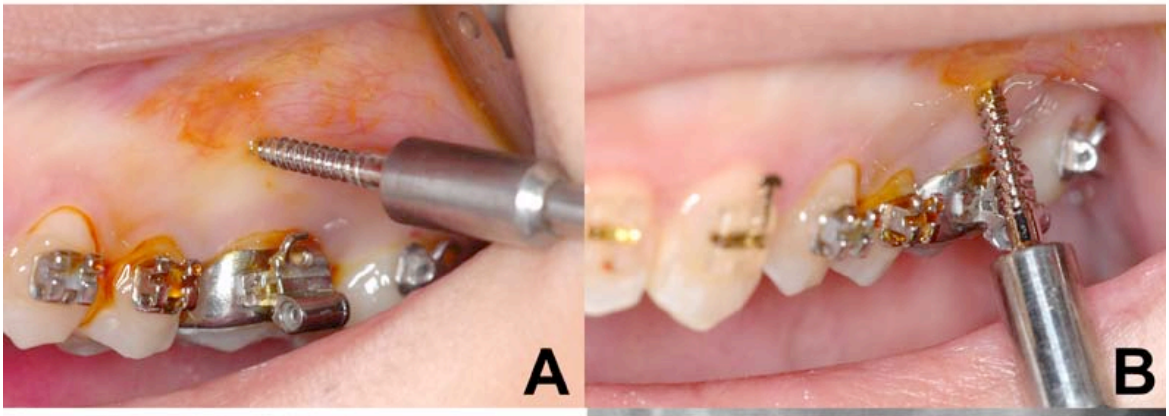


Fig 2



No incision
No tissue punch
No pre-drilling
Self-drilling

Fig 3

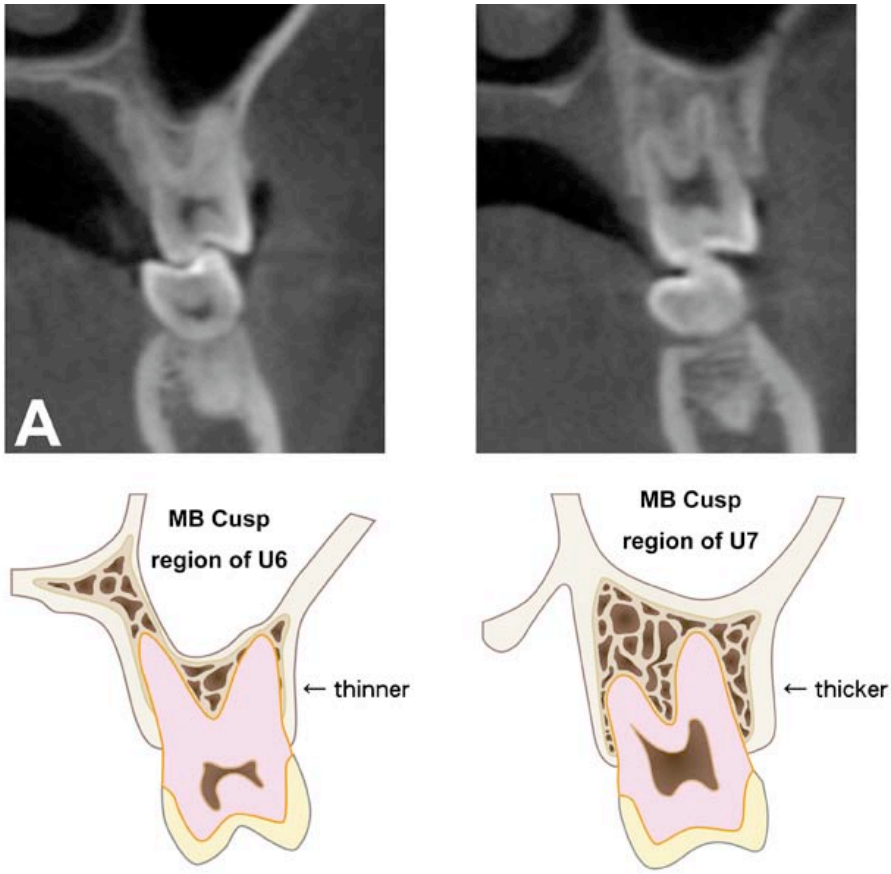

A
MB Cusp
region of U6
← thinner
MB Cusp
region of U7
← thicker

Fig 4

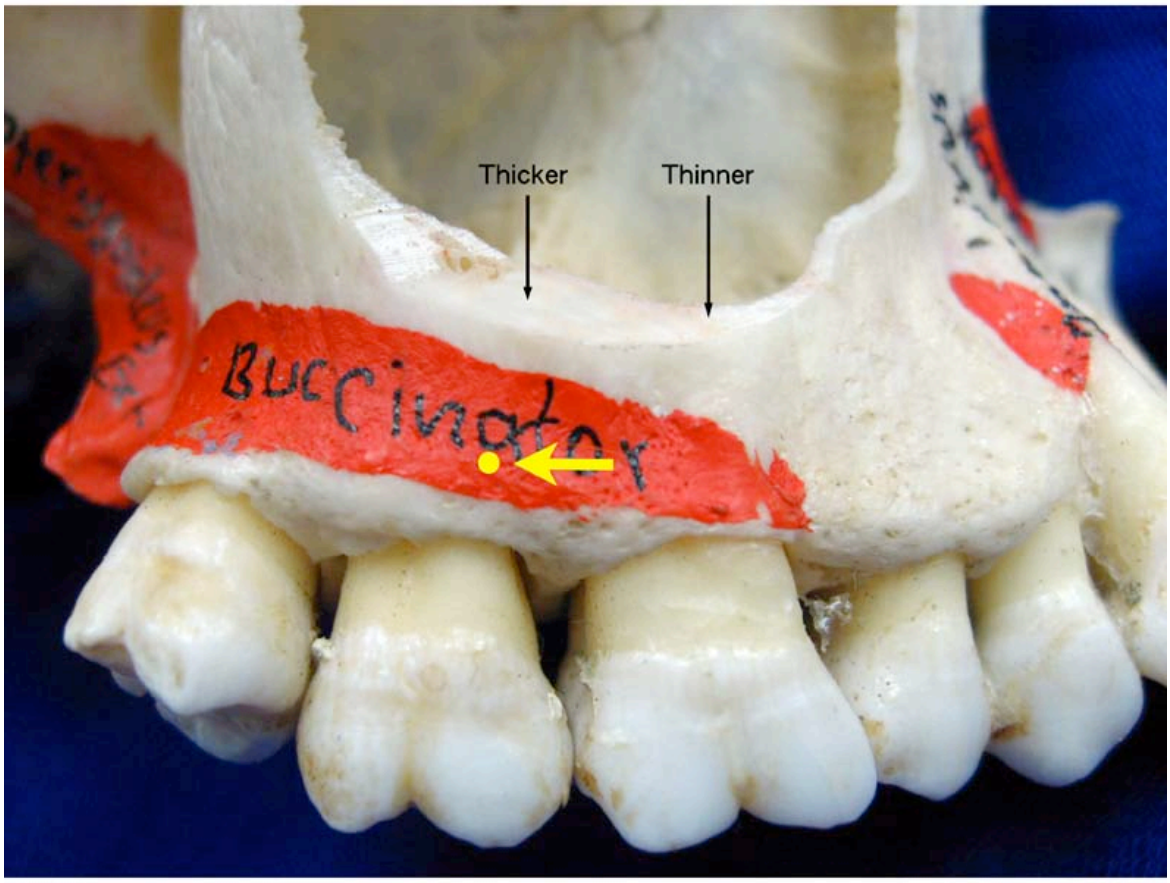

Thicker
Thinner
Buccinator

Fig 5

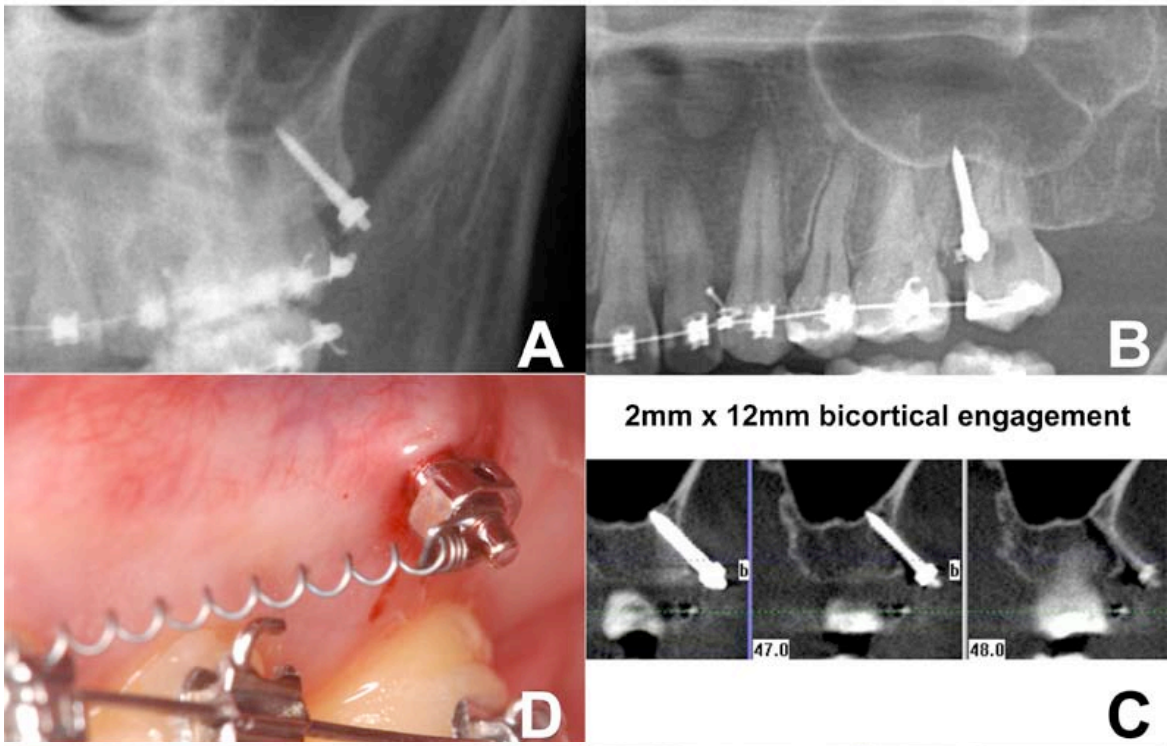
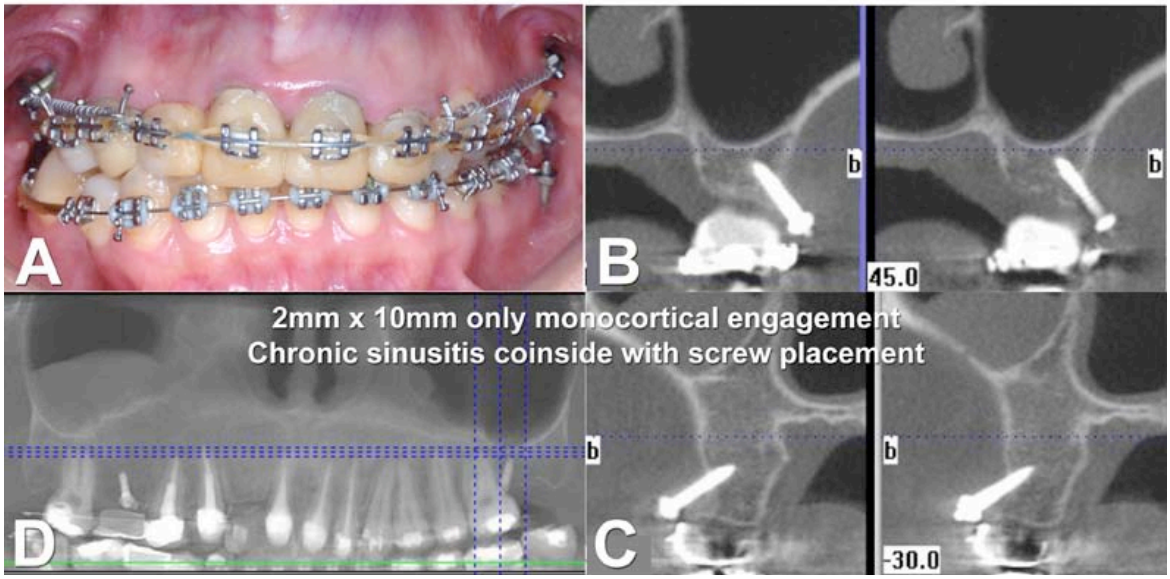

A
B
2mm x 12mm bicortical engagement
47.0
48.0
C
D

Fig 6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2mm x 10mm only monocortical engagement
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Fig 7


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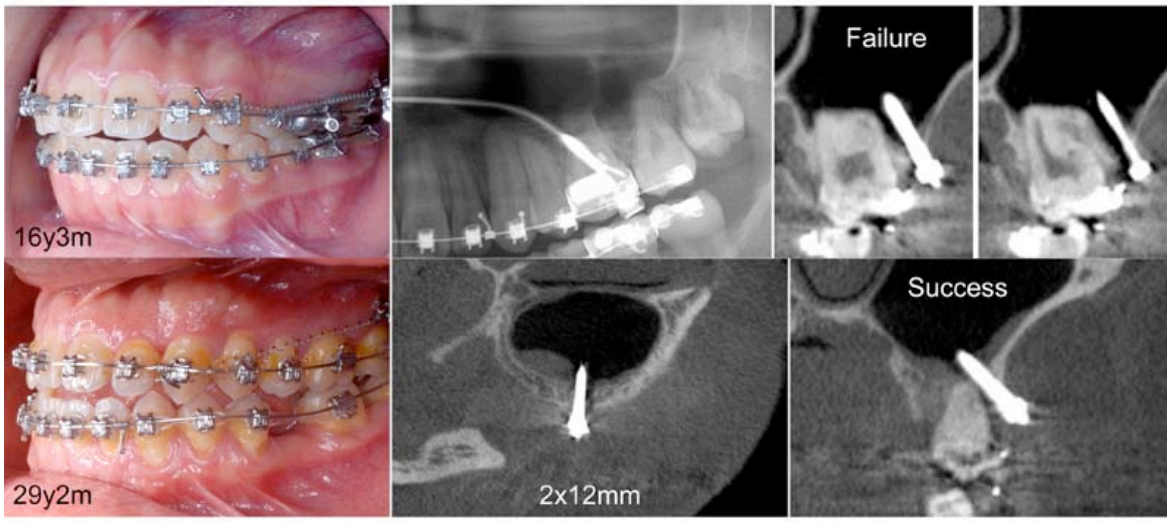
Narrow zone of attached gingiva mucogingival sinution
CR
CL

Fig 8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