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Case Report

# Full Arch Distalisation using Infrazygomatic Crest and Buccal Shelf Implants

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ABSTRACT

This article reports the successful use of Infrazygomatic crest and buccal shelf implants in the maxilla and mandible to treat a female patient of age 13-years. The patient had a skeletal Class I pattern and Angles class I malocclusion. Temporary anchorage devices (TADs) in the posterior dental region between maxillary and mandibular second premolar and first molar teeth on both sides were used as anchorage for full arch distalization. The patient received a satisfactory occlusion and an attractive smile. This technique requires minimal compliance and is particularly useful for correcting bimaxillary protrusion cases.

**Keywords:** Class I Malocclusion; Distalization; Temporary Anchorage Devices

## 1 INTRODUCTION

One of the most crucial aspects of orthodontic therapy is anchorage. Usually, other teeth in the mouth or headgear attached to the head or neck deliver it extraorally or intraorally. Temporary anchoring devices (TADs), such as osseointegrated implants or miniscrews, provide skeletal anchorage. When Kanomi launched miniscrew anchorage in 1997, it quickly gained popularity among orthodontic professionals, especially when more sophisticated miniscrews were created [1,2]. For both erupted and impacted teeth, miniscrews in interradicular and other intraoral sites provide anchoring for dental retraction, protraction, intrusion, and extrusion. Miniscrews have a history of significant failure rates, especially when they come into touch with the periodontal ligament (PDL) next to the tooth roots [3].

The introduction of infra-zygomatic and buccal shelf screws can just provide that ray of hope together with limiting the time required for re-treatment. However, they need to be used judiciously. The anatomic limits, art, bio mechanical perspectives, and the side effects are of prime considerations to master the technique [4].

### *1.1 Extra radicular bone screws and their difference with micro-implants*

Although both extra-radicular bone screws (IZC, BS) and micro-implants are classified under temporary anchorage devices – micro-implants are placed in between the roots of teeth (mostly) – intra-radicular, while bone screws are placed away from the roots in the infra-zygomatic areas of the maxilla and the buccal shelf areas of the mandible – extra-radicular. Both of them however are used for the purpose of skeletal anchorage.

### *1.2 Difference in sizes between bone screws and micro-implants*

While the regular size of a micro-implant ranges between 6 and 11 mm in length and 1.3–2 mm in diameter depending on the clinical situation, it needs to be used for; bones screws are comparatively larger in size ranging from 10 to 14 mm in

length and a minimum diameter of 2 mm. Just like a micro-implant may be available as a short or a long head one, bone screws are also available as a short or a long collar depending on the anatomic site and the clinical situation it needs to be used for. Their head shapes may also vary just as micro-implants, the common being mushroom shaped.

### *1.3 Difference in the choice of material between bone screws and micro-implants*

Almost every micro-implant available in the market is made with an alloy of – titanium, aluminum and vanadium (Ti6Al4Va) and bone screws are also available with similar compositions but the choice of material is pure stainless steel. Bone screws are generally placed in areas of DI (>1250 HU) quality bone (IZC and BS areas) and therefore requires greater fracture resistance. Stainless steel provides greater fracture resistance than Ti alloy and is therefore the preferred material of choice [4].

## 2 CASE REPORT

The patient, 13 -year-old girl, had a convex profile and angles Class I malocclusion. Her chief complaint was forwardly placed upper and lower front teeth.

The clinical examination reveals that the skeletal Class I base with prognathic maxilla and orthognathic mandible relationship, proclined and forwardly placed maxillary and mandibular anteriors, protrusion of upper and lower lips and competent lips.

A pretreatment extra-oral, intra-oral photographs Figure 1 and cephalogram and a panoramic radiograph [Figure 2 ] were taken before treatment. The cephalometric analysis [Table 1].

### *2.1 Treatment Objectives*

The treatment objectives were to create a satisfactory occlusion maintaining a Class I molar relationship and anddecrowding in maxillary and mandibular anteriors. Correction of axial inclination of maxillary and mandibular anteriors with distalisation of the maxillary and mandibular teeth were indicated.

### *2.2 Treatment Progress*

Orthodontic treatment lasted for 23 months. Preadjusted edgewise aplliance 0.022 MBT brackets were bonded to all teeth. With sequential nickel-titanium archwires, alignment and leveling were achieved in 4 months. Then, after decrowding in upper and lower anterior teeth a posted archwire of 0.019-0.025 SS wire place in maxillary and mandibular arche.

After 4 months of distalisation of the maxilla, the first molars were maintained in Class I relationship, facial profile and smile is improved. Posttreatment intra-oral and extra-oral photographs are shown in Figure 3. Posttreatment lateral cephalogram and orthopantomogram (OPG) is shown in Figure 4.

**Fig. 1:** A pre-treatment extra-oral

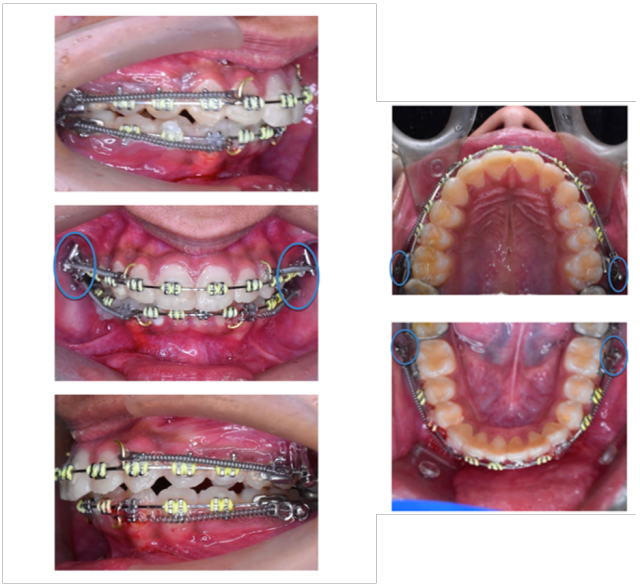


**Fig. 2:** Infrazygomatic crest implant and buccal shelf implant placement for distalisation

**Fig. 3:** Pre-treatment cephalogram

**Fig. 5:** Post treatment lateral Cephalogram

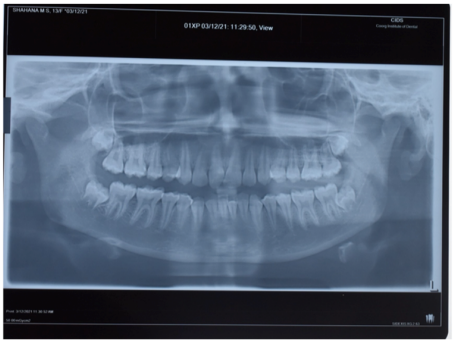


**Fig. 4:** Pre-treatment orthopantomogram (OPG)

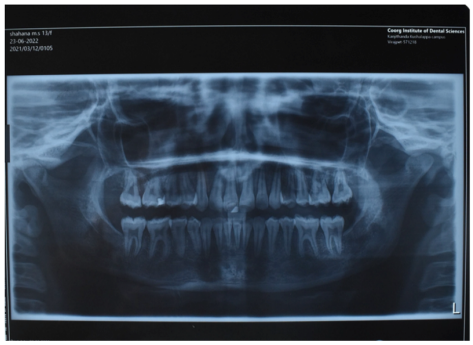
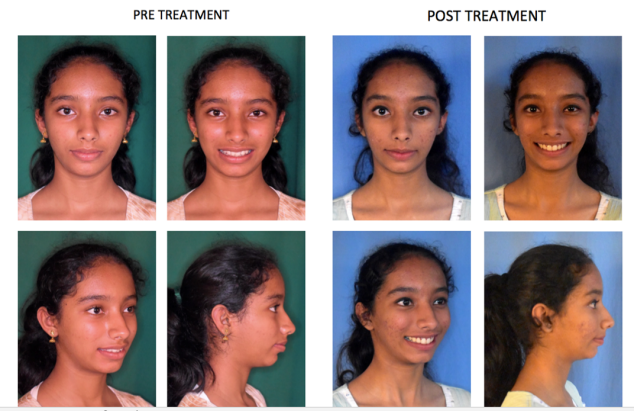


**Fig. 6:** Post treament OPG


## 3 DISCUSSION

Orthodontic treatment with mini-screw anchorage is more comfortable for the patient than traditional reinforced anchorage such as multi-brackets combined with intraoral or extraoral anchorage, because there is no requirement for the patient's cooperation. Nevertheless, the success rate was approximately 80-95%, and minimum invasion for placement surgery was necessary; the patients complained of little pain and discomfort after placement of the mini-screws[5].

The center of resistance (Cres) of the maxillary dentition has been shown to be located around the middle area of the premolar roots. The more interproximal alveolar bone is available between the maxillary second premolar and first molar roots and between the maxillary first and second molar roots than in other locations[1].

### *3.1 Material and Size*

The choice of material is pure stainless steel because of its high fracture resistance than titanium alloys. They are available in two sizes commonly – 12 and 14 mm in length and 2 mm in diameter. When the soft tissue in the buccal vestibule is thick a 14 mm screw is used. These have 7 mm of head and collar area and 7 mm of cutting spiral. Orthodontic bone screws of 12 mm length are preferred in cases of thin soft tissue at the vestibule. The length of cutting spiral, head, and collar dimensions may vary according to the choice of manufacturer[6].

The decision for placing the mini screw is dependent on the bio-mechanics and the local anatomy of that particular region. Local anatomy varies with different individuals, but some sites are more reliable and show more bone thickness than others. The two most important factors for the primary stability of the implant are the quality and quantity of bone. CBCT may be used to study this, though the gold standard for studying the quality of bone is biopsy[7].

In several case reports, IZC screws were used as anchorage for retraction of the entire maxilla to correct Class II malocclusion and/or bimaxillary protru- sion. Failure was defined as the inability of an IZC BS to serve as adequate anchorage to accomplish the intended orthodontic purpose for 6 months. This interval was the minimal anchorage requirement to retract the maxilla in the present sample. Additional study is indicated to determine the long-term failure rate relative to the overall anchorage needs for specific patients . Movement of an IZC BS within bone was not considered a failure if the device continued to provide the anchorage intended. TAD failures may include screw fracture, mobility, uncontrollable soft tissue inflammation, and/or host factors (pain or root damage)[8].

## 4 LIMITATIONS

1. Young subjects has less dense cortical bone in infra zygomatic crest and mandibular buccal shelf region
2. Ozdemir et al. stated that increased vertical skeletal pattern will has reduced cortical bone thickness and thus effect the primary stability of orthodontic anchorage screw. Miyawaki et al. reported that patients with high mandibular plane angle will have low success rate.
3. Poor oral hygiene, local inflammation around screw and type of mucosa surrounding the bone screw are the factors which affect the stability. Viwattanatipa et al. reported infra zygomatic crest has low non-keratinized tissue. Non keratinized tissue has less resistant to the effect of plaque which could be one of the reasons to affect primary stability of orthodontic anchorage screw.
4. Chang et al. stated, primary stability is effected because of less attached gingiva and presence of movable mucosa in infra zygomatic crest and mandibular buccal shelf region.

The driving of the IZC screws into the bone begins 14-16mm above the maxillary occlusal plane at an angle of 90° to the occlusal plane. After a couple of turns, the mini-screws handle is turned to an angle of 55° to 70° to avoid damage to the roots of the molar teeth. The angle less than 55° technically is said to be easier but biting depth is reduced hence lacks stability and there is a higher failure rate with the above-mentioned angle. There is also a chance of alveolar or buccal mucosa irritation. An angle greater than 75° faces technical difficulty in placement, there might be slippage of IZC screws, bone stripping and also there is a greater chance of damage to the mesiobuccal root of the molar. Hence, the angulation between 55°-70° is chosen[9].

## 5 CONCLUSION

As anchorage is the prime goal of many treatment of malocclusion and skeletal anchorage play a absolute role we must know the importance of every type of skeletal anchorage system with their pros and cons[10].

| PARAMETERTS | IDEAL | PRE TREATMENT | POST TREATMENT |
|---|---|---|---|
| SN ORIENTATION | 7° | 10° | 10° |
| INTERMAX.SAGITTAL:ANB | 2° | 7° | 7° |
| AO TO BO | 1MM 0MM | AO 3MM ahead of BO | AO 2MM ahead of BO |
| BETA ANGLE | 27°-35° | 29° | 26° |
| INTERMAX.ANALYSIS FOR MAXILLA:SNA | 82±2 | 89°<br>PROGNATHIC MAXILLA | 85° |
| MAX SIZE[SN*.7] | ANS-PNS | 53(44.1)mm<br>Maxilla larger in size | 54(44.1)mm<br>Maxilla larger in size |
| EFF MAX LENGTH | CO-Pt A | 92mm | 87mm |
| MAX POSITION SNF-Pt m | 18 mm | 19mm | 17mm |
| MAX.ROTATION [N Se-ANS-PNS] | 85° | 85° | 83° |
| INTERMAXILLARY ANALYSIS FOR MANDIBLE: SNB | 80°±2° | 82° | 78° |
| MAN SIZE[SN*1.05] | Go-Pog | 63 (66.15)mm<br>Mandible smaller in size | 67 (66.15)mm |
| EFF MAN LENGTH | Co-Gn | 107mm | 109mm |
| INTERMAX. VERTICAL RELATION:SN-GOGN | 32 ° | 29° | 32° |
| FMA | 25° +/-5 | 20° | 24° |
| Upper pharynx width | 15-20mm | 15mm | 14mm |
| Lower pharynx width | 11-14mm | 14mm | 12mm |

| PRAMAETERS | IDEAL | PRE TREATMENT | POST TREATMENT |
|---|---|---|---|
| DENTOALVEOLARREADING: INTERINCISAL ANGLE | 131° | 92°proclined incisors. | 118°proclined incisors. |
| U1-SN | 102° | 122° proclined upper incisors. | 101° |
| U1-NA | 22°,4MM | 38°,5mm proclined and forwardly placed upper incisors | 22°,4mm |
| L1-MP | 95° | 114° proclined lower incisors. | 109° proclined lower incisors. |
| L1-NB | 25°,4MM | 45°,5mm proclined and forwardly placed lower incisors | 37°,5mm proclined and forwardly placed lower incisors |
| L1-APOG | 22°,4MM | 36°,5mm proclined and forwardly placed lower incisors | 35°,4mm proclined lower incisors |
| U1-NF(+NF) | 30.5±2,27.5±1.7 | 30mm | 27mm |
| L1-MP(+MP) | 45±2,40.8±1.8 | 47mm supraocclusion | 37mm |
| U6-NF(+NF) | 26.2±2,23±1.3 | 18mm infraocclusion | 19mm infraocclusion |
| L6-MP(+MP) | 35.8±2.6,32.1±1.9. | 29mm | 30mm |
| SOFT TISSUE FACIAL ANGLE | 90-92° | 95° concave facial profile | 90° |
| NASOLABIAL ANGLE | 102±8° | 115° obtuse | 118° obtuse |
| MENTOLABIAL ANGLE | 122±10° | 90° hyperactive mentalis activity | 91° hyperactive mentalis activity |
| E LINE TO U-LIP | -4MM | 0mm (Protrusive) | -1mm (Protrusive) |
| E LINE TO L-LIP | -2MM | 2mm (protrusive) | 2mm (protrusive) |

**Fig. 7:** CIDS analysis pre treatment

There are hardly any complications associated with the use of implants. Ideally, fully erupted third molars are to be removed to create a space and aid in distalization process. For unerupted third molars placed below the cemento-enamel junction of the second molars in young individuals, distalization is possible without their extraction [(11)].

Through this case report we can conclude that mini-screws placed in the maxillary buccal interradicular space between the second premolar and the first molar at an oblique angle were useful for moving molars distally in patients.

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