

## MINI SCREW IMPLANT TAKING ORTHODONTICS TO NEW DIMENSIONS – A CASE REPORT.

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### ABSTRACT

Attainment and control of anchorage is fundamental and critical in orthodontics. Anchorage control throughout the orthodontic treatment is essential for uncompromised results. Conventional means of supporting anchorage have been using either tooth borne anchorage or extra oral anchorage. Tooth borne anchorage is one of the greatest limitations of modern orthodontic treatment because tooth moves in response to forces. Extra oral anchorage can be used to supplement tooth borne anchorage, but requires excellent patient co-operation. Skeletal anchorage would offer tooth movement in any direction without detrimental reciprocal forces and simultaneously solving the problem of patient compliance. They expand the range of biochemical possibilities and orthodontic forces might be applied directly to the jaws through skeletal anchorage. In this case report, we are explaining an approach for skeletal Class I bialveolar protrusion, with microimplant anchorage used for retracting the maxillary anterior teeth.

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### INTRODUCTION

Advantages of using miniscrew implants during orthodontic treatment are that, they are small enough to place in any area of the alveolar bone, easy to implant and remove, and inexpensive and reduces total treatment duration. In addition, orthodontic force application can begin almost immediately after implantation[1]. In this article, we are explaining an approach for skeletal Class I bialveolar protrusion, with microimplant anchorage used for retracting the maxillary anterior teeth.

### CASE REPORT

The patient, an 16-year-old male, had a convex profile and a Class I skeletal pattern with bialveolar protrusion (Fig. 1). Cephalometric analysis showed an ANB (relative difference in the anteroposterior relationship of the maxilla / Point A and mandible / Point B in relation to Nasion is measured as ANB) angle of 7°, a mandibular plane angle (FMA) of 24° (Table 1). The overjet and overbite were 5 mm and 2 mm each. The canine and molar relationships were Class I, but the maxillary incisors and mandibular incisors were proclined (U1 to N-A 32°, IMPA 100°). The treatment plan called for extraction of both the maxillary and mandibular first premolars, followed by fixed appliance treatment using maxillary micro-implants for anchorage control.

After the extractions of all first premolars, molars were banded and the remaining teeth were bonded with 0.022" slot MBT appliance system (3M Unitek Gemini Metal Brackets) and .016" NiTi (OrthoForm III) wires were placed. After the initial alignment was achieved the

archwires were upgraded to a 0.019" X 0.025" HANT (OrthoForm III) and left in place till the slots were leveled. Once aligning and leveling was achieved, subject was placed with 0.019" X 0.025" posted SS wire (Posted OrthoForm III) incorporated with a standardized torquing curve and left for 4 weeks before the commencement of space closure to allow the residual tip and torque to be expressed (Fig. 2).

The implant used in this study was a mini screw (Absoanchor - SH 1312-08) having a diameter of 1.3mm and a length of 8mm. Periapical X-rays were taken with guide bar (jig) to standardize the exact position and to determine whether adequate space was available for implant placement[2]. To obtain 8 mm biting depth without injuring the adjacent structures, the screw insertion was angulated at 40° and 8mm gingival to the archwire.

Retraction was planned after 4 weeks of implant placement and done using NiTi closed coil spring (3M Unitek Medium, 9mm), stretched between the implant and the post of the 0.019 X 0.025 SS wire in maxillary arch. For mandibular arch, NiTi closed coil spring was stretched between the molar hook and the post of the 0.019 X 0.025 SS wire. The methods controlling the mode of anterior teeth retraction were the vertical position of the anterior hooks on 0.019 X 0.025 posted SS wire and the amount of torquing curve (reverse curve) given on the archwire. The torquing curve incorporated into the archwire produces an intrusive force and generates a labial crown torque on

anterior teeth which helps to enhances the vertical and torque control of the anterior teeth[3].

Dontrix gauge was used to check 150gms of force which was applied using Niti closed coil spring for both the arches. Patient was recalled at regular interval of 4 weeks. At each visit the springs were checked such that a force around 150gms was maintained, while the arch wire was checked for any damage to prevent any interference with sliding. Most of the profile improvement occurred during the first 11 months of treatment (Fig. 3).

The patient showed good Class I skeletal and dental relationships after 18 months of total treatment time (Fig. 3). The facial profile was improved with the retraction of the upper and lower lips. The ANB angle was reduced from 7° to 4°, (Table 1). The proclined maxillary and mandibular incisors were uprighted by 8°. Cephalometric superimposition demonstrated a bodily retraction of the maxillary and mandibular anterior teeth. The maxillary molars moved slightly distally and showed a small amount of intrusion.

**DISCUSSION**

Orthodontic treatment with fixed appliances commonly involves moving teeth along an archwire to close residual extraction spaces. When clinicians select a force delivery system for this purpose, they hope that it would apply a force which will be of sufficient duration to achieve tooth movement in an efficient and effective manner, without causing damage to the tooth or periodontal structures. How much force is required for tooth movement is debatable, particularly since factors such as friction and the effects of the oral environment need to be taken into consideration. Bone remodelling is not initiated by momentary heavy forces, but by repeated forces, provided that these are above a minimum load. For this reason, it is important that any space closing system used in orthodontics is capable of applying a force of sufficient magnitude and duration to achieve tooth movement without causing irreversible damage to the root and periodontal ligament.

While applying NiTi closed coil springs for retraction there is increased consistency because of its identical length and it is stretched directly between two fixed points. NiTi closed coil springs are designed to deliver a low constant force. Unlike the elastomeric systems, the force applied is primarily material dependent rather than primarily clinician dependent. It has long been established that elastomeric products exhibit force decay with time, whereas NiTi coil springs retain the majority of their initial force. The ideal magnitude of force for space closure in orthodontics was found to be between 150 and 200 g. The NiTi closed coil springs delivered an initial force magnitude closer to the ideal, and were more resistant to force degradation than the elastomeric chains. The NiTi closed coil springs, however, presented gentle and progressive force decay over 28 days[4]. Superelasticity allowed the NiTi closed coil springs to deliver a constant low force over a wide range of clinical activation. Thus it can be stated that NiTi coil spring appears to be a superior choice to consistently deliver light, continuous forces during space closure[5].

The resistance of micro screw implant to force that occurs during retraction depends on the mechanical retention and osseointegration of the implants to the bone[6]. It has been suggested that a waiting period is not necessary for miniscrews, because their primary stability

(mechanical retention) is sufficient to sustain normal orthodontic loading[7], and this would not compromise the clinical stability of the miniscrews. The waiting period was 4 weeks in this study and it was long enough for soft tissue healing but not long enough for osseointegration. The number of days from implantation to force application was not associated with stability. It is suggested that immediate loading of a screw-type implant anchor is possible if the applied force is less than 2 N. Such immediate loading is probably possible because of successful mechanical interdigitation between the implant anchor and the alveolar bone in the posterior region[8].

It was suggested that miniscrews, a waiting period for bone healing and osseointegration before loading is unnecessary because the primary stability (mechanical retention) of the miniscrews is sufficient to sustain a regular orthodontic loading. The microscrew implants placed in this study showed no mobility throughout treatment. They were loaded with 150g of force 4 weeks after placement.

The length of the titanium screws, used as means of anchorage did not have any relation with stability if the screw was longer than 5 mm. On the other hand, the diameter of the screw was significantly associated with its stability. As the maxilla is composed more of cancellous bone, the length of the implant should be longer and thinner in contrast that of mandible. The implant used in this study was a mini screw (Absoanchor - SH 1312-08) that had a diameter of 1.3mm and a length of 8mm which could withstand as much as 450g of force. Most orthodontic applications need forces of less than 300g. Therefore sufficient mechanical interdigitation between the screw and the cortical bone is an important factor that affects the stability of the screw type implant anchor[9].

**Table 1 : Cephalometric Values**

| VARIABLE                                | NORMAL                 | PRE R <sub>x</sub> | POST R <sub>x</sub> |
|---|------------------------|--------------------|---------------------|
| <b>Sagittal Skeletal Relationship:</b>  |                        |                    |                     |
| SNA                                     | 82°                    | 92°                | 87°                 |
| SNB                                     | 80°                    | 85°                | 84°                 |
| ANB                                     | 2°                     | 7°                 | 4°                  |
| Wits appraisal                          | AO ahead of BO by 4 mm |                    |                     |
| <b>Dental Base Relationship:</b>        |                        |                    |                     |
| U1 to NA ( mm/deg)                      | 22°/4mm                | 32°/9mm            | 24°/4mm             |
| L1 to NB (mm/deg)                       | 25°/4mm                | 33°/12mm           | 25°/5mm             |
| U1to SN Plane                           | 102°                   | 111°               | 102°                |
| L1 to Mand Plane (IMPA)                 | 90°                    | 100°               | 92°                 |
| <b>Dental Relationship:</b>             |                        |                    |                     |
| Inter- incisal angle                    | 131°                   | 104°               | 126°                |
| L1 to APo line                          | 1-2 mm                 | 7mm                | 2mm                 |
| Over bite                               | 2-4 mm                 | 2mm                | 2mm                 |
| Overjet                                 | 2-4 mm                 | 5mm                | 2mm                 |
| <b>Vertical Skeletal Relationships:</b> |                        |                    |                     |
| Max - Mand planes angle                 | 25°                    | 24°                | 28°                 |
| SN Plane - Mand Plane                   | 32°                    | 30°                | 30°                 |
| Upper anterior face height              | 51.5-57.9              | 49mm               | 49mm                |
| Lower anterior face height              | 66.2±5.1               | 70mm               | 70mm                |
| Jarabak Ratio                           |                        | 70%                | 68%                 |
| Maxillary Length                        | 89.2±5.2               | 103mm              | 103mm               |
| Mandibular Length (McNamara)            | 114.9±7.1              | 122mm              | 122mm               |
| <b>Soft Tissues Relationship:</b>       |                        |                    |                     |
| Lower lip to Ricketts E Plane           | 3mm                    | 6mm                | 1mm                 |
| Nasolabial Angle                        | 90° - 110°             | 96°                | 92°                 |

Figure 1; Pre Treatment Photographs & Radiographs

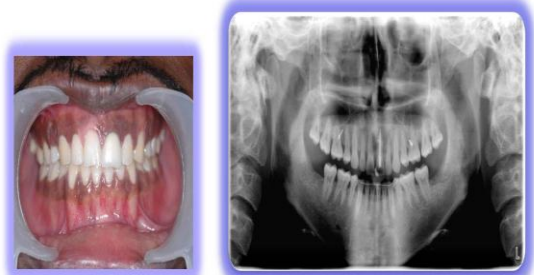


Figure 2; During Treatment Photographs



Figure 3; Post Treatment Photographs & Radiographs

**CONCLUSION**

Micro-implant treatment has the following advantages in the management of Class I bialveolar protrusion cases -

- Does not depend on patient compliance with extraoral appliances.
- Produces an early profile improvement, giving the patient even more incentive to cooperate.
- Shortens treatment by retracting the six anterior teeth simultaneously.
- Provides absolute anchorage for orthodontic tooth movement

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