Achieving Excellence in Finishing with Microimplants in Orthodontics : A Case Report

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Introduction

Goal of any orthodontic treatment is to achieve desired tooth movement with a minimum number of undesirable side effects. Strategies for anchorage control have been a major factor in achieving successful orthodontic treatment since the specialty began. Edward Angle, in 1900, was one of the earliest to advocate the use of equal and opposite appliance forces to control anchorage. Traditionally, anchorage was reinforced by increasing the number of teeth bilaterally or using the musculature, extraoral devices, and the alveolar processes, However, the use of extra-oral anchorage depends heavily on patient compliance and extended wear time - objectives that are difficult to achieve[1].

Achieving absolute anchorage has been one of the dreams of the practicing orthodontist, and very rapidly microimplants have become one of the most effective and powerful tools for achieving absolute anchorage. This new treatment approach is causing a paradigm shift in orthodontic treatment planning[2]. At present, the smallest diameter microimplants (1.2 to 1.3 mm) are used widely due, in part, to the fact that they can be placed between the roots of adjacent teeth. Many successful treatment outcomes have been reported in which microimplants placed between the roots have provided absolute anchorage enabling en masse retraction, molar intrusion, molar distalization, molar protraction, and molar uprighting. The most striking use has been in providing an alternative to orthognathic surgery (particularly in the vertical dimension) in select cases and allowing asymmetric tooth movement in three planes of space including correction of occlusal cants. These were the movements earlier believed to be beyond the scope of conventional orthodontics[3].

Nomenclature & Microimplant Design

The term implant is used instead of screw, because when a foreign object is retained in the human body for more than one month, it can be classified in the implant category.

The term mini- is used when the diameter of an implant is 1.9 mm upto 2.5mm.

The term micro- is used when the diameter of the implant is between 1.1mm upto 1.9mm. This small diameter allows placement in the inter-radicular regions making them useful for orthodontic purpose.

Microimplants (Fig. 1) have a special button-like head with a small hole that can accept ligature wire, coil springs and orthodontic elastomers easily, a hexagonal/ rectangular transmucosal shaft that can be grasped readily by the screwdriver during insertion and a threaded endosseous shaft that is implanted into the bone. The transmucosal neck/shaft is smooth to reduce plaque accumulation/ inflammation.

Path of Microimplant Insertion - The microimplant is inserted at an angle of 30 to 60 to the long axes of the teeth, both buccally and lingually. A more oblique insertion for narrow interradicular region would prevent root damage whereas a more perpendicular direction would provide more retention.

Most patients report no noticeable pain or side effects such as infection after microimplant placement or removal. However, the clinician should prescribe appropriate analgesics and antibiotics so that they are available if needed.[4]

Case Report

A 24 years old female patient reported to the department with a chief complain of forwardly placed upper and lower front teeth and increased visibility of gums on smiling.

Patient was dolicodephalic with an increased lower anterior face height. The face was slightly asymmetrical with incompetent lips. Patient has a gummy smile with upto 5 mm of gingival visible on smiling. **O/E Extraoral (Fig. 2)**

Patient had a convex profile with an extended lower lip, hypotonic upper lip and retrusive chin. **Intraoral (Fig. 3)**

Angles class I molar relation with a proclination of maxillary and mandibular incisors. There was mild crowding in upper and lower anterior region. The canine relationship was class II and the overjet was 5mm and overbite of 2mm. The curve of spee was 3mm and there was distobuccal rotation of mandibular 2nd premolar bilaterally. The midlines were coincident.

Model Analysis

- Arch length tooth material discrepancy revealed.
- Boltons analysis .
  Overall ratio : 2.1 mm mandibular excess
  Anterior Ratio : 1.8 mm mandibular Anterior excess.

Space Analysis

- .4mm space were required for the correction of proclination in the upper arch.
- 8 mm space were required for the correction of the proclination, 3mm for resolution of crowding and 4mm space were required for the leveling of curve of space in the lower arch.

Cephalometric Analysis

- Showed a class II skeletal base with a slightly prognathic maxilla and retrognathic mandible.
- The mandibular angle was increased showing a vertical growth pattern.
- The maxilla and mandibular incisors were proclined on their respective skeletal bases.
- Soft tissue analysis show an acute nasolabial angle and protrusive upper and lower lips.

Treatment Objectives

1. Correction of crowding
2. Correction of upper and lower incisor proclination
3. Level the curve of spee.
4. Maintain class I molar relation and achieve class I canine and incisor relation.
5. To decrease the maxillary incisor show and achieve lip competence

Treatment plan

1. All 1st premolars extraction plan with fixed mechanotherapy. All the first premolars consist of 7.5 mm in width
2. Maximum anchorage with micro-implants in upper and lower posterior region for anchorage control in AP and vertical direction.

Treatment Progress

Fixed treatment was done by using MBT (0.22 slot) prescription brackets. The second molars were not banded initially due to vertical growth pattern. A transpalatal arch was placed 3mm away from the palate to achieve an intrusive effect on the molars. Initial treatment was started with upper/lower .014 HANT wires and then .016 HANT were placed. Three months after commencement of treatment 018 SS wires were placed for alignment and leveling of the arches. 19×25 heat activated Ni Ti were placed at five months. Microimplants (Fig. 4) were placed in between the second premolars and the first molar just below the mucogingival junction at the same time. In the next appointment 19×25 stainless steel wires were placed and left for two months so as to completely express themselves. 5mm power arms were soldered between the lateral incisor and canine on both the side .tie back were given directly from the impants to the power arm for the retractionfor 7months. After the space closure proper intercuspation was achieved with settling elastics (red) on 0.016 SS in upper and 0.014 NiTi in the lower ach for 3 months. Retention was planned with the hawley's appliance in the upper arch and the fixed bonded retainer in the lower arch.

The cephalometric superimposition (Fig. 5) and analyses (Table 1) illustrate the skeletal and dental changes that occurred during treatment. There was a reduction in ANB and Wits appraisal to 1°. FMA was reduced by 4°, Vertical facial growth continued,with no significant effect on overall vertical skeletal proportions. The

maxillary incisor inclination decreased by 7mm while the lower incisor inclination reduced by 8mm.The principal aim of correcting the Proclination of upper and lower incisiors and improve the profile of the patient was successfully accomplished along with coincident centrelines. The final occlusal fit was good and reasonable dental alignment was achieved, with the exception of the second molars as the patient was vertical grower but they were involved in the finishing stage to get them in the alignment. The achievement of a well interdigitated buccal segment occlusion with good buccal overbite, as well as the use of a rigid upper Hawley retainer and the bonded retainer in the lower arch will help to prevent the reopening of spaces.

Post treatment photographs (Fig. 6,7) and post treatment cephalogram reveals the marked change in the skeletal and dental parameters and thus improve the soft tissue profile of the patient. Micro implants are the best tool for the anchorage and enhance the treatment outcome.

Conclusion

At this point in time, we cannot achieve a 100% success rate when we use micro implants for temporary skeletal orthodontic anchorage[5]. However, microimplants do have a high success rate of approximately 90%, a rate that is similar to that of miniplates and large titanium screws. Microimplants can be used for anchorage immediately after placement for any type of orthodontic tooth movement. 12 Microimplants are small enough to be placed virtually in any area of the mouth. If a microimplant fails, another implant can be placed immediately in an adjacent area[6].

By using microimplants for absolute anchorage during orthodontic treatment, the field of orthodontics has been widened to include many new therapeutic possibilities.

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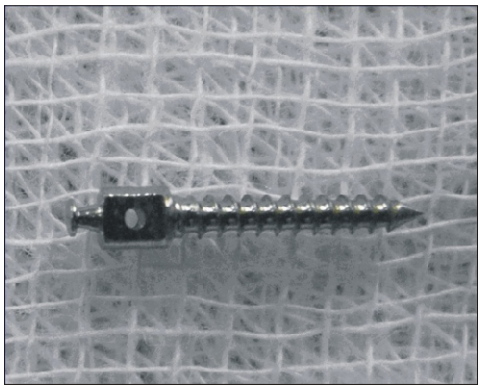


Fig. 1 : Microimplants

Pre-Treatment

Fig. 2 : O/E - Extra-Oral Photographs

Fig. 3 : Extra-Oral Photographs

Fig. 4 : Mid-Treatment Intra-Oral Photographs with Implants

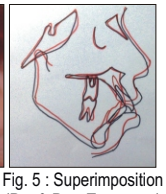


Fig. 5 : Superimposition (Pre & Post Treatment)

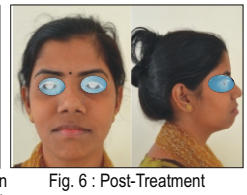
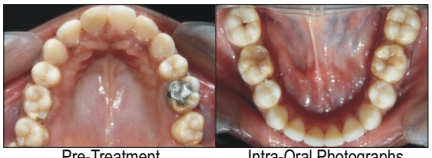


Fig. 6 : Post-Treatment

Extra-Oral Photographs



Pre-Treatment Intra-Oral Photographs

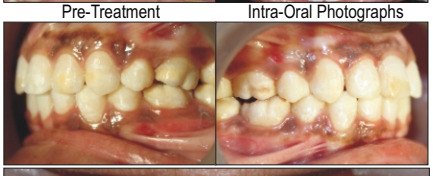


Fig. 7

Fig. 8 : Pre-Treatment Cephalogram

Post-Treatment Cephalogram

Table - 1

Charity 24 / F	Reference Range	Pre-Treatment	Post-Treatment
SNA	82	78	79
SNB	80	71	73
ANB	2	7	6
N Perp. to point A	0-1	3 mm	3 mm
N perp. to pogonion	-2±2	-7 mm	-7 mm
SN-Go-Gn	32	38	36 mm
Jaraback's ratio	62.65%	58.3%	60%
FMA	25	35	33
Upper 1 - NA	4 mm / 22°	10 mm / 33°	3 mm / 20°
Lower 1 - NB	4 mm / 25°	14 mm / 43°	6 mm / 26°
Interincisal Angle	131-150	100	133
IMPA	90	101	88
Nasolabial Angle	102±8	84	94