Temporary anchorage devices in orthodontics

*Gowri sankar.Singaraju
** Vasu Murthy

Professor of orthodontics, St Joseph Dental college, Eluru.
Professor of orthodontics, Kamineni institute of dental sciences, Narketpally

Abstract

Anchorage control is one of the main aspects of orthodontic treatment plan. A good appliance system should put minimum taxation of anchorage on the anchor units. The structures present with in the confinement of oral cavity are very less in number. In such cases the anchor unit gets its reinforcement from extraoral structures or intraoral appliances. Extraoral anchorages have their inherent drawbacks and most of them rely on patient cooperation. The use of implants in orthodontics to reinforce the anchorage is a recent concept. The purpose of this article is to review the implants in the context of orthodontics which are called as TAD- temporary anchorage devices.

Key words: Temporary anchorage devices, Orthodontics, Implants.

Introduction

Anchorage control is one of the most important aspects of orthodontic treatment. The success of orthodontic treatment hinges on the anchorage protocol planned for a particular case. Use of extraoral anchorage devices such as headgears requires full patient cooperation, which is sometimes not possible and is unpredictable. Introduction of implants in orthodontics have solved this problem. Implants have become one of the best sources of reliable anchorage. Mini implants have revolutionized the field of anchorage in orthodontics.

1-3 (Table-I)

This new modality has been called by several names, some of the popular ones are

- Mini implants
- Microimplants
- Skeletal anchorage
- Temporary anchorage Device

Use of implants as a source of anchorage has number of advantages as compared to traditional anchorage such as no patient cooperation, easy to use, shortening of treatment time, good control on tooth movements.

Branemark and co-workers* (1965) reported the successful osseointegration of titanium implants in bone; many orthodontists began investigating in using implants for the purpose of orthodontic anchorage. Gainsforth and Higley (1945) placed metallic vitallium screws in dog ramus. Linkow (1969, 1970) used mandibular blade-vent implants in a patient to apply class II elastics, Sherman’ (1978) placed the first orthodontic implants. Block and Hoffman (1995) introduced the onplant to provide orthodontic anchorage.

CLASSIFICATION OF IMPLANTS FOR ORTHODONTIC ANCHORAGE* (Table-II)

1. According to the shape and size:
   I) Conical (Cylindrical)
      a) Miniscrew Implants
      b) Palatal Implants
      c) Prosthodontic Implants
   II) Mini plate Implants
   III) Disc Implants (Onplants)

2. According to Implant bone contact:
   I) Osteointegrated
   II) Non-osteointegrated

3. According to the application:
   I) Used only for orthodontic purposes. (Orthodontic Implants) or TAD (temporary anchorage devices)
   II) Used for prosthodontic and orthodontic purposes.

MINISCREWS(Fig.1) Of all orthodontic implants, miniscrews have gained considerable importance due to less surgical procedure and easy installation. Titanium
miniscrews may be an ideal anchorage system that fulfills the clinical needs of the orthodontist. Some of their benefits include dependability, are well accepted by patients, can be immediately loaded, and are simple to insert and remove, and conform to the anchorage needs of the orthodontist/ The miniscrew can be loaded immediately with forces in the range of 50 to 300. This anchorage system can be used to support a variety of orthodontic tooth movements in clinical situations involving mutilated dentitions, poor cooperation.

### Table 1. showing the difference between conventional anchorage and implant anchorage

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>TRADITIONAL ORTHODONTIC TREATMENT</th>
<th>ORTHODONTIC TREATMENT USING IMPLANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchorage Source</td>
<td>Teeth and extraoral bony structures</td>
<td>Implants</td>
</tr>
<tr>
<td>stability of anchorage</td>
<td>Position of anchor teeth is not stable during treatment</td>
<td>Position is stable during treatment</td>
</tr>
<tr>
<td>Number of Anchor teeth</td>
<td>In order to get sufficient anchorage, maximum number teeth must be included</td>
<td>For direct anchorage teeth are not necessary, minimal number of teeth are needed for indirect force on implant anchorage</td>
</tr>
<tr>
<td>Treatment Efficiency</td>
<td>Applying force on teeth, part of it is wasted, due to periodontal amortization</td>
<td>More efficient as force is transmitted directly to the implant</td>
</tr>
<tr>
<td>Duration of the treatment</td>
<td>Treatment time prolonged</td>
<td>Shortened treatment time</td>
</tr>
<tr>
<td>Patient's cooperation</td>
<td>Obligatory</td>
<td>Minimal</td>
</tr>
<tr>
<td>Treatment acceptability</td>
<td>Most of treatment devices restrict patients motion, don't meet esthetical requirements</td>
<td>Discomfort for patient is minimal</td>
</tr>
</tbody>
</table>

### MINIPLATES (Fig.2)

The Miniplate Implants are comprised of bone plates and fixation screws. The plates and screws are made of commercially pure titanium that is biocompatible and suitable for osseointegration. The miniplate consists of the three components—the head, the arm, and the body.

The head component is exposed intraorally and positioned outside of the dentition so that it does not interfere with tooth movement. The head component has three continuous hooks for attachment of orthodontic forces. There are two different types of head components based on the direction of the hooks.

**Onplants (Fig 3)** These are button type implants used in the palatal region. They serve as anchorage source for expansion as well maxillary protraction.

**Common Indications for placement of implants**

Mini implants are used most beneficially where three dimensional stable anchorage is needed, some of these situations are:

1. Where you can not afford any movement of reactive units (maximum anchorage case)
2. Patient with several missing teeth making it difficult to engage posterior units
3. For difficult tooth movements, eg intrusion of anterior and posterior segments and distalisation
4. Where asymmetrical tooth movement is needed
5. To treat borderline cases with non extraction method
6. Doing extreme orthodontics when patient is not willing to undergo orthognathic surgery.
SITES OF PLACEMENT:

**MAXILLA** (Fig. 4)

- Infrazygomatic crest area.
- Tuberosity area.
- Between 1st and 2nd molars buccally.
- Retromolar Area.
- Between 1st and 2nd molars buccally.
- Between 1st molar and 2nd premolar buccally.
- Between canine and premolar buccally.

**MANDIBLE** (Fig 5)

- Between 1st molar and 2nd premolar buccally.
- Between canine and premolar buccally.
- Between incisors facially.
- Mid palatal Area.

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**Table 2. TYPES AND FEATURES OF ORTHODONTIC IMPLANTS**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>CHARACTER</th>
<th>MINI SCREWS</th>
<th>ORTHODONTIC IMPLANTS</th>
<th>MINI PLATES</th>
<th>ONPLATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anatomical sites for implantation</td>
<td>Every structure where there is enough cortical bone</td>
<td>Median suture of the palate, paramedian</td>
<td>Every structure where there is enough cortical bone</td>
<td>Median suture of the palate, paramedian</td>
</tr>
<tr>
<td>2</td>
<td>Patient’s age</td>
<td>no age contraindications</td>
<td>Used after ossification of the median suture of the palate</td>
<td>no age contraindications</td>
<td>Used after ossification of the median suture of the palate</td>
</tr>
<tr>
<td>3</td>
<td>Time of Loading</td>
<td>Immediate loading</td>
<td>Loading after osseointegration is complete (3-6 months)</td>
<td>Loading after healing</td>
<td>Loading after osseointegration is complete (3-6 months)</td>
</tr>
<tr>
<td>4</td>
<td>Type of Surgery</td>
<td>Only perforation of the mucosa is needed</td>
<td>Perforation of the mucosa and bone preparation is needed</td>
<td>Flap surgery is needed</td>
<td>Flap surgery is needed</td>
</tr>
<tr>
<td>5</td>
<td>Postsurgical period</td>
<td>Minimum patient's discomfort</td>
<td>Pain and Swelling remains for a week</td>
<td>Pain and Swelling remains for a week</td>
<td>Pain and Swelling remains for a week</td>
</tr>
<tr>
<td>6</td>
<td>duration</td>
<td>For Orthodontic anchorage, removed after treatment</td>
<td>For Orthodontic anchorage, removed after treatment</td>
<td>For Orthodontic anchorage, removed after treatment</td>
<td>For Orthodontic anchorage, removed after treatment</td>
</tr>
<tr>
<td>7</td>
<td>Size</td>
<td>1, 2-2, 3mm diameter, 6-14mm length</td>
<td>3.3mm diameter, 4-6mm length</td>
<td>2mm diameter, 5m m length(screw)</td>
<td>10mm diameter, 2mm thickness</td>
</tr>
</tbody>
</table>

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**Methods of placement**

(1) **Pre-tapping method:** In this method the miniscrews is driven into the tunnel of bone formed by drilling, making it tap during implant driving. This method is used when we use small diameter miniscrews.

(2) **Self tapping:** Here a slight notch is made and then the screw is tapped in bone.
Uses of orthodontic implants¹⁻¹¹ (fig 6)
- Used for retraction of anterior teeth (Class II Div I).
- Uprighting of molars,
- Mesiodistal tooth movement,
- Open bite correction (archived by intruding posterior. Molar Intrusion teeth: skeletal anchorage)
- Molar Mesialization:
  - Distalization of 1st and 2nd molars (Graz implant supported pendulum: GISP)
- Intrusion of anterior teeth as well as molars
- Onplants for expansion and protraction of maxilla—orthopedic use.

CONCLUSION:
Implants provide absolute anchorage i.e. complete bone anchorage. Implants have revolutionized the field of anchorage in orthodontics. So by choosing a correct anchorage source we can get good results in orthodontic treatment

References