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Applications Of Orthodontic Micro Implants

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ABSTRACT :

In orthodontics, Anchorage has been a worrisome factor for many years. Many modalities have been tried in the scientific literature for preserving the anchorage using the extraoral and intraoral devices, yet the speciality of orthodontics did not find any convenient solutions to this problem until the introduction of mini-implants. Various skeletal anchorage devices were introduced in the 20th century which includes prosthetic implants, palatal implants , mini-plates and screws. The implants used in orthodontics are also known as temporary anchorage devices (TADs), have become increasingly popular because they are small and easy to insert and remove, they can be loaded immediately after insertion, and they can provide absolute anchorage for many types of orthodontic treatment, with minimal need for patient compliance. This article reviews their indications, contraindications, safety zones for TADs, their insertion procedure, complications, failures and medicolegal aspects

KEYWORDS: Anchorage, Mini-Implants, TADS

INTRODUCTION :

As the orthodontic treatment proceeds, patient's teeth are exposed to forces & moments. All these forces acts in opposite direction. These forces need to be directed for the success of the treatment and prohibit unwanted tooth movements. Anchoragemanagement methods are of great concern in orthodontics. The final goal in orthodontic treatment is to achieve desired tooth movement along with improvement in patients esthetics.

Evolution of Implant System:

In 1700's John Hunter , Scottish Surgeon suggested the possibility of transplanting human teeth..In 1809, Maggiolo placed single tooth sized gold implant in fresh extraction site just above gingiva. In 1911, Greenfield described the fabrication & insertion of an endo-osseous implant .

CLASSIFICATION OF IMPLANTS

ACCORDING TO :

Site of placement/ anchorage components

- Subperiosteal implant
- Transosteal implant
- Endosteal/ Endosseous implant

Surface texture -

- Small
- Treaded
- Perforated

Form –

- solid
- hollow
- vented

Spray or coating of hydroxyapatite or plasma sprayed titanium –

- Coated
- Non-coated

Head type –

- Small head type
- Long head type
- Circle head type
- Fixation head type
- Bracket head type

Implant morphology –

- Skeletal anchorage implant
- Zygoma anchorage system
- Straumannortho implant
- Aarhus implant
- Mini implant system
- Micro- implant
- C – implant
- Spider screw
- Implant disc[1.]

USE OF IMPLANTS AS ANCHORAGE :

The osseointegrated implants were the first to be used for the use of orthodontic anchorage. It posed good anchorage, but they have only limited application in terms of orthodontic usage[2]. The waiting period was nearly 3 to 4 months to integrate before they could be placed. So the size of implants and the placements were also problematic.

- **Biological properties –**
  - Should provide effective osseointegration.
  - It Should not be toxic to hard and soft tissues of the oral cavity.
  - It Should not have the toxic diffusible substance.
  - It Should have no carcinogenic potential.

- It Should betasteless,odourless[3].

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➢ **Physical properties -**

- It Should be dimensionally very stable.
- It Should have adequate strength and resilience.

MINI IMPLANTS :

- Orthodonticmini implants are made up of pure titanium.
- It is available in different diameters and length.

MINI IMPLANT SCREW DESIGN :

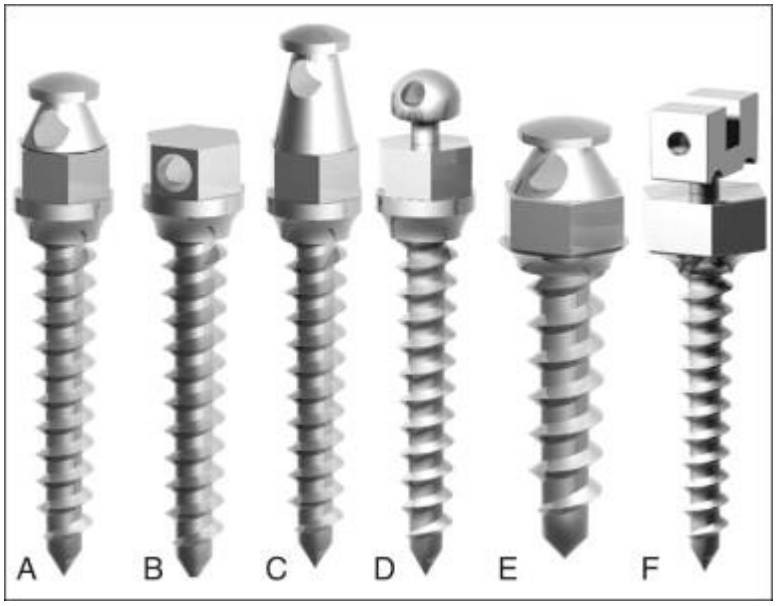
Mini implants have 4 components –

- **Head**– It has a slot for application of orthodontic archwire.
- **Neck** – It is a connection between head and platform for placement of an elastic, NiTi coil springs and other accessories.
- **Platform** – It is of 3 various sizes (1mm, 2mm,3mm) for adaptation of different soft tissue thickness at different site of implants.
- **Body –** It is parallel shaped,selfdrilling with wider diameter and deep thread pitches. It provides excellent mechanical retention.(fig1)

(Fig.1)

MICRO IMPLANTS :

During the initial stages of development of microimplants, surgical microscrews were used. These screws were 1.2 mm in dia and 5 to 10 mm in length. The success rate of these surgical screws varied from 80% to 90 %, depending on the site of placement[8]. One of the chief drawbacks of these surgical screws was a lack of any "superstructure" on the head for attaching elastics. To circumvent this problem, ligature wire was tied on the neck (under head of screw) and then bent up to make a hook. This hook caused persistent inflammation around microscrew implants



- **A, small head (SH)**
- **B, no head (NH)**
- **C, long head (LH)**
- **D, circular head (CH)**
- **E, fixation head (FH)**
- **F, bracket head (BH).(fig.3)**

SIZE OF MICRO IMPLANTS :

- Microimplants ranging from 1.2 to 1.6 mm in diameter are enough to be placed in anatomical locations of the mouth, including the palate, chin, retromolar area, and interradicular spaces between teeth roots[9].
- After placement, at least 6 mm of the total length of the micro implant should be placed into the bone in the maxilla and 4 mm in the mandible.
- The useof microimplants 7 to 8 mm long in the maxillary buccal alveolar bone and 5 to 6 mm long in the mandibular buccal side.
- The most common diameter of the microimplants is 1.3 mm in the maxilla and 1.4 mm in the mandible and 1.5 or 1.6 mm in the midpalatal area where there are no teeth present.

SAFE ZONES OF IMPLANT PLACEMENTS :

- As the mini screw is small and thin, it is easy to place in any part of alveolus for its needed mechanical stabilization.
- Between second premolar and first permanent molar
- Between the first and second permanent molar
- Between the two central incisors, which is particularly good for intrusion
- Infrazygomatic region – zygomatic buttress
- Palatal areas where the thickness and quality of cortical bone are excellent.
- Maxillary tuberosity region

- Mid palatal areaetc..

SCREW ANGULATION :

If we see at the area from canine to the second premolar in the maxilla, the cortical bone buccally is thin. So the angulation in this area is mandatory to make sure that the screw does not touch the roots. The space between the roots is shaped like an inverted pyramid. The Space gradually goes on increasing in width to about 5mm as the root taper apically. If we place the micro- implant at 30- degree to 40 -degree angle to the long axis of the teeth in the maxilla, it will keep the screw in the widest space available between the roots apically[11]. In the mandible, the buccal cortex is of dense bone and curves out more buccally from gingival margins. So the shorter screw can be used than those used in the maxilla. Also the angle is reduced to 10- degree to 20- degree with little risk of touching the roots.

SURGICAL PROCEDURE :

- **Topical anesthesia** – recommended before soft tissue infiltration to reduce the needle prick pain.
- **Infiltration anesthesia** – only the soft tissue infiltration anesthesia is required to determine that whether the implant is touching the roots of teeth or not. If it is touching the roots, the drill can be redirected away.
- **Aseptic preparation** – a disinfecting agent can be used to prepare an intraoral or extraoral site for keeping the surgical area aseptic.A guide bar can be placed on the tooth before exposing IOPA[6]. The guide bar can be placed in such a manner that it should be retained during micro implant insertion, which helps in placement of a micro- implant.
- **Drilling** – loading of the selected micro screw into the driver is done, and the screw is inserted at the registration point. The direction of insertion is first horizontal and then angulated at 30 -degree to 40-degree in the maxilla and 10- degree to 20- degree in the mandible[12]. The act of turning the screw should be smooth alternating between turns and stops. Wobbling in the axis of a driver should be avoided to ensure proper stability of implants.
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LOADING OF IMPLANTS :

- It includes the Delayed loading and immediate loading. According to the studies carried out by Branemark, it was thought that all implants should undergo a healing period of 4-6 months before functional loading. Many of the clinical experiences and researches have proven that premature loading causes the micromotion of the implants which causes failureof implant[7].
- Loading also includes the dynamicand Static loading which has shown that statistically loaded and unloaded implants has more cortical lamellar bone at the neck and the apex of implants. The implants which are dynamically loaded showed the bone craters and howships lacunae around the implant neck indicating higher levels of bone resorption.
- The timing of Orthodontic force application- In terms of orthodontic mini-implants, the primary stability is more important than the osseo-integration. So it has been found clinically that no significant difference exists between the immediate loading and delayed loading when the force of 200- 300 gms.is applied after achieving primary stability. However, it may be better to wait approximately 2-3 weeks for soft tissue healing.

STABILITY OF IMPLANTS :

- Stability of implants is the factor of great concern whether the implant is osseointegrated or mechanically retentive.

- It includes the – Primary and secondary stability[8]
- Primary stability or initial stability is achieved immediately after the insertion of an implant. It is the prime factor of consideration for healing and loading.
- The contributing factors responsible for achieving the primary stability includes- Implant diameter,the length of implant,the number of flutes and design of threads, cortical bone thickness and also the bone density. It also depends on the placement technique and the location of implant placement.
- Secondary stability after the implant placement the bone regeneration and remodeling contributes to increasing the stability which is referred to as the secondary stability .

RISK AND COMPLICATIONS OF ORTHODONTIC IMPLANTS

Complications During Insertion :

- Trauma to the periodontal ligament or the dental root
- Orthodontic implant slippage
- Nerve involvement
- Air subcutaneous emphysema
- Nasal and maxillary sinus perforation
- Implants bending, fracture, and torsional stress.

Complications under Orthodontic Loading :

- Miniscrew migration
- Complications during removal
  - Screw fracture
  - Partial osseointegration and soft tissue complications.

PSYCHOLOGICAL AND MEDICO-LEGAL ASPECTS :

Psychological:

The increased use of implants for orthodontic purposes makes it necessary to deal with psychological aspects, for both the operator and the patient[9].

The operator (orthodontist) :

Clinicians prefer to avoid unnecessary surgery.
Methods are currently limited to an adult patients (not growing patients).
.Interdisciplinary training must be standardized.

The patient:

When presenting implant treatment to an adult patient. The clinician must explain the advantages and the disadvantages of this method. All the different possibilities are to be be discussed with the patient in an attempt to understand his or her motivation. The informed consent document should be signed by the patient. Special care will be needed with patients who are especially anxious or uncooperative.

MEDICO-LEGAL ASPECTS

Age of treatment: In younger patients, where there is a possibility that the implant might interfere with bone growth, especially the osseointegrated structures, the ankylotic behavior of the fixtures must be considered, including the processes of resorption and apposition and that of dislocation linked to the growing period; the

temporary nature of the implant must be taken into account. Implants must not interfere with structures that govern the processes of growth (sutures) or with nonosseous anatomical structures (nervous, vascular).

Indications for the use of implants for anchorage: The choice of using implants must be made in relation to the principle of maximum results with a minimally invasive method (cost/benefits) so that over-treatment can be avoided[10].

Informed consent: The informed consent document should contain appropriate information about the method of placement, its characteristics, the surgical techniques (in the various phases), and the possibility of irritation or local inflammation during traction.

CONCLUSION :

The introduction of dental implants into dental treatment plans has had a tremendous impact on the field of dentistry. Hence, in future the implants might evolve as a boon in the field of dentistry.

REFERENCES :

1. Bjork Ludwig, Dr.Baumgaerteletal.Mini-implants in orthodontics. London: Quintessence Publishing co.ltd

2. P.Salehi, S. Trkan. The use of mini-implants in revolving Orthodontic Problem.Orthodontic- Basic aspects and clinical consideration. Orthodontic Research centre, ShilazUni.of Medical Science- Iran, March 9, 2012. Pg- 195-218

3. Samuel RHA, Jones ML. Orthodontic facebow injuries and safety equipment. Eur.JOrthod 1994;16:385- 394

4. Gainsforth BL, Highley LB. A study of orthodontic anchorage possibilities in basal bone. Am J Orthod1945;31:406-17.

5. Linkow LI. The endosseous blade implant and its use in orthodontics. Int J Orthod 1969; 18:149-54.

6. Branemark PI, Breine U, Adell R. Intraosseous anchorage of dental prostheses. I. Experimental studies. Scand J PlastReconstrSurg 1969; 3:81-100.

7. Roberts WE, Smith RK,Y. Silberman Y, Mozsary P-G, Smith RS. Osseous adaptation to continuous loading of rigid endosseous implants. Am J Orthodont 1984; 86:95- 111.

8. Creekmore TD, Eklund MK. The possibility of skeletal anchorage.JClinOrthod 1983; 17:266-69.

9. Cope Jason. Temporary Anchorage devices in Orthodontics: A Paradigm shift. Seminar in orthodontics. 2005; 11: Pg. 3-9

10. Roberts WE, Helm FR, Marshall KJ, Gongloff RK. Rigid endosseous implants for orthodontic and orthopedic anchorage. Angle Orthod 1989; 59:247-56.