Journal of Research in Medical and Dental Science
2022, Volume 10, Issue 11, Page No: 034-038

Available Online at: www.jrmds.in
eISSN No.2347-2367: pISSN No.2347-2545

Mini Implants-A Quest for Absolute Anchorage

Samiksha R Thawri*, Pratiksha Lakhe, Pallavi Daigavane

Department of Orthodontics, Sharad Pawar Dental College and Hospital, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India

ABSTRACT

Anchorage has long been a source of concern in orthodontics. Although many techniques for preventing anchoring using extra oral and intraoral devices have been tested in the scientific literature, the specialty of orthodontics has not found any practical answers to solve this issue till the development of mini implants. Several types of skeletal anchorage systems, including as palatal implants and implants, mini plates, and screws, were introduced in the twentieth century. Temporary anchorage devices have grown in popularity, since they are compact and uncomplicated to place and withdraw, they can be loaded just after implantation, and they give complete anchoring for a range of orthodontic procedures with minimal patient compliance. This study will discuss in brief about the temporary anchorage system in terms of their indications, criteria for implant placement, safe zones for implant insertion, screw angulation and design, problems and maintenance.

Key words: Anchorage, Mini implants, Tads

HOW TO CITE THIS ARTICLE: Samiksha R Thawri, Pratiksha Lakhe, Pallavi Daigavane, Mini Implants-A Quest for Absolute Anchorage, J Res Med Dent Sci, 2022, 10 (11): 034-038.

Corresponding author: Samiksha R Thawri
E-mail: samikshat221@gmail.com
Received: 29-Aug-2022, Manuscript No. JRMDS-22-47346;
Editor assigned: 01-Sep-2022, PreQC No. JRMDS-22-47346 (PQ);
Reviewed: 15-Sep-2022, QC No. JRMDS-22-47346;
Revised: 31-Oct-2022, Manuscript No. JRMDS-22-47346 (R);
Published: 08-Nov-2022

INTRODUCTION

Sir Isaac newton gave laws, out of which his third law action is equal to reaction plays an important role in orthodontics since it explains a lot of what we see throughout therapy [1]. After starting of the orthodontic therapy, the teeth are subjected to stresses and moments. These stresses tend to apply reciprocal forces in opposite direction. In order for therapy to be successful and undesired motions to be avoided, this pressure must be directed. The anchoring protocols are provided here, and they form the foundation of all orthodontic therapy. However, due of the instability of teeth when used for anchorage, it has been discovered that teeth chosen for purpose of anchorage frequently move at the same time with at which the motion is necessary, and that little or no influence on the basal bone can be created. Since teeth have been discovered to be insufficiently stable to produce the needed alterations in dentures and basal bone, another source of resistance has become desirable. As a result, it was estimated to be that gaining anchorage from a place within the basal bone would considerably improve stability [2].

Mini screws also are termed as TADs (Temporary Anchorage Devices), Micro implants, or Ortho implants, and have revolutionised the area of clinical orthodontics. A temporary anchorage device is momentarily attached to bone in order to improve orthodontic anchorage, either through continuing to support the reactive unit's teeth or by completely eliminating this need for reactive unit, and then it can be removed. It can be found transostcally, endosteally, and it could be mechanically (cortically stabilised) or biochemically attached to the bone (osseointegrated) [3-5]. According to the current findings, TAD anchored MP may have a higher impact on maxillary advancement. Extrusion of maxillary molars, proclination of maxillary incisors, mandibular rotations are all minimized by TAD anchored MP [6]. The use of dental implants, mini plates, and screws as anchorage has made it possible to move the anterior or posterior teeth (or both) distally without losing support. Miniscrew implants, for example, provide the advantages of ease of placement and removal, as well as limited anatomical limits due to their small size and inexpensive cost [7]. There are two sorts of miniscrew implants, according to papadoullus [8], and they can offer two types of results. They are connected to the reactive unit *via* bars or wires when used for indirect anchorage, but when used for direct anchorage, they directly receive the reactive forces by serving as an anchor unit. The palatal bone, the infrazygomatic crest, the maxillary and mandibular bucco alveolar cortical plate, the palatal side of the maxillary alveolar process, the mandibular retro molar area, and the posterior palatal alveolar process have all been used for mini screw insertion. The mandibular buccal shelf has recently been identified as a viable implantation area for extra alveolar mini screws [9]. For widening the border of tooth movement without patient compliance, skeletal anchorage with temporary anchorage devices has been frequently

used in orthodontic therapy. TAD skeletal anchoring is particularly beneficial for addressing malocclusions with vertical issues, such as open bite and tooth over eruption due to antagonist loss. However, if patients are willing to accept a longer treatment duration, orthodontic intervention with TAD skeletal anchoring is a conservative strategy for treating that causes slight irreparable harm [10]. The repair of the continuous defect created by en bloc removal surgery has always been a challenge for doctors, with free tissue exchange, titanium implants, and individual specific implants all being choices [11].

LITERATURE REVIEW

History

In 1945, BL Gains forth and Higley developed the first absolute anchorage system. In mongrel dogs, vitallium screws were utilized to create total anchoring for tooth movement. The term "orthodontic anchoring" refers to the ability to resist unwanted tooth movement [12]. Anchorage of the skeleton entails. Surgical screws, mini plates, or prosthetic devices are implanted into the bone and used as absolute anchors. In eastern Asian countries, implant orthodontics is growing rapidly and advancing, and it will become a crucial modality in advanced orthodontic treatment over the next ten years. There are various advantages to this method over previous systems: a smaller fixture, easier surgical techniques and less damage, lower expense and complication, and greater clinical evidence.

Even though the theory of orthodontic anchoring is been known ever since 17th century [13]. These does not appear to have been defined explicitly till the 1923, Louis Ottofy [14]. When defined it as "the base against which orthodontic force or orthodontic force reaction is applied." Daskalogiannakis [15] lately described anchoring as "resistance to undesired tooth movement." These can alternatively be described as reactive unit's maximum range of motion. The active unit and the reactive unit must both be clarified when using this term. The growth and refinement of traditional orthodontic anchorage, dental implants, and orthognathic fixation methods led to the invention of temporary anchorage devices. Eventually, these procedures were united with biomechanical concepts of osseointegration into orthodontic dynamics and basic biology, which was eventually refined depending on interdisciplinary dentistry observations.

Classification of implants for orthodontic anchorage

According to the size and shape

- Cylindrical
    - Palatal implants
    - Prosthodontic implants
    - Mini screw implants
- Disk implants
- Mini plate implants

According to the application

- Used for prosthodontics and orthodontic purposes
- Used only for orthodontic purpose

According to implant bone contact

- Osteointegrated
- Non osteointegrated

Indications

- Anchorage system for extraction treatment
- Open bite treatment
- Antero posterior discrepancies corrections
- Rapid maxillary expansion
- Tooth extrusion
- Open bite treatment

DISCUSSION

Use if implants as anchorage

The first implant utilised for orthodontic anchoring was the osseointegrated implant (end steal). They did a good job of providing orthodontic anchoring, but their orthodontic use is limited. They were mostly used in edentulous spaces that were not available in typical orthodontic treatments.

Another flaw was the time it took to do the task. Before they can be loaded, patients must wait about 3-4 months for the implant to integrate. The implant's size and implantation method were both problematic. The size is substantial, and the surgical technique to implant it is difficult [16]. These issues and complications were overcome by non osseointegrated miniimplants used in orthodontics, which were also mechanically stabilised cortical implants. Mini screws are those with a diameter of 2 mm or greater, while micro screws are those with a diameter of less than 2 mm.

Implant materials

Nontoxic and biocompatible, the material must also have great mechanical qualities and be resistant to stress, strain, and corrosion. Bios tolerant, bio inert and bioactive are the three types of materials commonly employed. Titanium is frequently utilised and considered an ideal material because of its properties (no allergic or immunologic reactions, and no tumour growth). The surface of titanium oxide, which is exposed to air or tissue fluid, is where bone grows.

Implant sizes

Fixtures for implants must have primary stability and be able to tolerate mechanical forces. The total bone implant contact surface determines the maximum load. The contact area is determined by length, diameter, shape, and surface design. The best orthodontic anchorage fixture size has yet to be found. Implants of various sizes, ranging from "micro implants" (6 mm long, 1.2 mm diameter) to normal dental implants (6-15 mm long, 3-5

mm diameter), has proven to enhance anchorage. As a result, the size of the implants should match the amount of bone accessible at the surgery site as well as therapy plan.

Implant shape

The amount of bone implant area of contact provided for strain transmission and early stabilization is determined by shape. The design must minimise surgical damage while providing adequate primary stability. It can be difficult to pinpoint the "ideal" implant form. Cylindrical shapes with a smoother or thread surface are the most prevalent. The roughness of the surface has been linked according to the level of osseointegration in studies. Majority of orthodontic anchoring implants are identical to conventional designs. To provide better basic stabilization and long term implant therapeutic effectiveness, the implant shape and area can also be altered if necessary [17].

Safe zones for implant placement

Since the mini screw is small and thin, it can be easily inserted into any area of the alveolus to provide the necessary mechanical support. The operator is solely responsible for the placement. When employing micro implants, the clinician has the option of altering the location of miniscrews that serve as anchors to ensure that the task is completed well [18]. The implant must be positioned in the best possible way to achieve a natural looking aesthetic profile [19]. Miniscrew placement sites that are most regularly used are in the maxilla and mandible.

Maxilla: The width of buccal cortical bone on the complete maxillary alveolar process is restricted (3 mm to 4 mm), necessitating the use of lengthier screws. The most frequently used sites are:

- Mid palatal area
- Between the two central incisor and which is good for intrusion
- In region of maxillary tuberosity
- Interdental spaces of first and second permanent molar region
- Interdental spaces of second premolar and first permanent molar region
- Infrazygomatic region
- Palatal areas where quality and thickness of cortical bone is good

Mandible: Inter radicular alveolar area because the cortical bone on the buccal area of the mandible is dense, the screws are smaller in size, and root contact is unlikely. The most prevalent locations are:

- Retro molar area
- Interdental space of two central incisor
- Interdental space of second premolar and first permanent molar region
- Interdental space of first and second permanent molar region

Following are some of the anatomical and vital structures that should be avoided during micro implant placement: vein, maxillary sinus, artery, nasal cavity, inferior alveolar nerve, mental foramen. Since these implant sites are near to the arch wire plane, applying force to move the teeth and controlling the resulting counter forces is considerably easier. To avoid unintentional root contact, the screws must be tapered and thin used for orthodontic anchorage. Because of the dense bone, the maxilla length should be 8 mm to 10 mm and the mandible length should be 6 mm to 8 mm.

Screw angulation

The cortical bone buccally is thin with in area between the canine and the second premolar in the upper jaw. As a result, angulation under this region is required to ensure that the screw doesn't really come into contact with the roots. The area in between roots is inverted pyramid shaped. As that the root taper apically, the gap increases steadily in breadth to around 5 mm. The screw would be kept in the biggest area achievable in between roots apically the miniimplant is placed at a 30 to 40 degree angle to that of longitudinal plane of the teeth in the upper jaw.

The buccal cortex of the jaw is made up of thick bone that arches out a little more buccally from that of the gingival borders. As a result, a shorter screw than the one used inside the maxilla can be employed. In addition, the angle is decreased from 10 to 20 degrees, reducing the chance of hitting the roots [20].

Mini implant screw design

Transmucosally titanium alloy grade V is meant to be utilised as orthodontic miniimplants for osseous anchoring. There are four parts to an orthodontic micro screw:

Head: It has a slot for orthodontic arch wire installation.

Neck: isthmus in between head and platform where NITI coil spring, elastic or accessories can be attached.

Platform: Three sizes are available (1 mm, 2 mm, and 3 mm) to accommodate differing soft tissue thicknesses at various implant sites.

Body: With its wide diameter and deep thread pitches, it has a parallel shape and is self-drilling. It has superior mechanical retention, less loosening fracture, and more anchorage strength.

Implant driving method

Mini implants can be placed in one of two ways:

- **Self-tapping method:** The mini screw is forced into bone tunnel formed by drilling in this technique, causing it to tap as the implant is being inserted. This approach is used when employing small diameter miniscrews.
- **Self-drilling method:** miniscrew is inserted further into bone even without necessity for drilling in these processes. When we need to use miniscrews with a

wider diameter (than 1.5 mm), we can use this method.

Surgical procedure

- Topical anaesthesia
- Infiltration anaesthesia
- Aseptic preparation
- Drilling
- Root positioning of the implant

Loading of implants

It contains both delay and immediate loading options. Prior to functional loading, all implants were assumed to require a 4-6 month recovery period. Early loading induces implant micromotion, which results in implant failure. Whereas if implants are splinted properly, the micromotion is minimised, then the instantaneous loading of implants can be done. The utilization of dental implants with in cleft zone has increased recently, although the result of such a loaded dental implant right away for orofacial cleft individuals remains unclear [21].

Stability of implant

If whether implant is osseointegrated or technically retentive, implant stability is a major challenge. It consists of two parts:

- Primary stability, also known as initial stability, is acquired shortly after an implant is inserted. It is the most main thing to think about when it is associated with mending and loading.
- Secondary stability occurs after the implant has been placed and is defined as bone growth and remodelling that contributes to increased stability [22].

Mini implant problems

Screw related problems: If the transmucosal section of the screw is not completely smooth, infection can occur. When using screw system with different neck lengths, the doctor should choose the one that better serves the implant location.

Operator related problems: The tip of a self-drilling screw can be fractured if extreme stress is exerted throughout implant placement. The screw might loosen if it is over tightened. It is important to avoid rotating the screw whenever the smooth portion of the neck approaches the periosteum. Ligature must be positioned on the upper side of bracket like screw head with in a slot at right angle to the wire. The patient will be unable to keep the area free of inflammation if the ligature is turned around the screw.

When removing the screwdriver from the screw head, be careful not to jiggle it. The screw driver would not adhere unless the lengthy extension is withdrawn just prior to the portion around the screw.

Patient related problems: When the density of trabecular bone is low and 0.5 mm or thinner cortex, the prognosis of a mini implant for primary tooth is poor. When primary stability had attained, screw if put in location with significant bone remodelling due to resorption of a deciduous tooth or post extraction healing, loosening can occur.

Mini implants are not recommended for patients who have systemic changes in bone metabolism as a result of illness, heavy smoking and medication.

Implant maintenance

To ensure implant longevity the soft tissue surroundings should be maintained. Peri mucositis is caused by plaque accumulation along the gingival edge. Prolonged inflammation causes peri implantitis, or bone disintegration around implants, which can lead to implant failure if not treated properly. As a result, patients must be taught how to control plaque at home and receive expert care on a regular basis.

CONCLUSION

The purpose of the article is to emphasise usage of miniimplants as the temporary anchorage devices. Dental implants have made a significant impact in world of dentistry since they were first introduced into treatment programmes. Because of the growing interest in the field of implantology, there has been a lot of research into the usage of dental implants. The devices themselves are changing to enable the best mix of simplicity of placement (orthodontist placement), least invasive process, and best physical design features for delivering optimum mechanical forces. Finally, the absolute anchorage system is essential for successful orthodontic treatment, since it prevents issues like instability and unwanted force collateral effects. This sort of therapy may provide you more control over your orthodontic treatment.

REFERENCE

1. Jayakrishnan U, Jayaraj A, Shetty KN, et al. Mini screw Implants in Orthodontics a peek through into its various applications. J Indian Dent Assoc Attingal Branch 2019; 9:19.
2. Gainsforth BL, Higley LB. A study of orthodontic anchorage possibilities in basal bone. Am J Orthod Oral Surg 1945; 31:406-417.
3. Herman R, Cope JB. Miniscrew implants: IMTEC mini ortho implants. Semin Orthod 2005; 11:32-39.
4. Dalstra M, Cattaneo PM, Melsen B. Load transfer of mini screws for orthodontic anchorage. Orthod 2004; 1:53-62.
5. Ottoni JM, Oliveira ZF, Mansini R, et al. Correlation between placement torque and survival of single tooth implants. Int J Oral Maxillofac Implants 2005; 20.
6. Jia X, Chen X, Huang X. Influence of orthodontic mini implant penetration of the maxillary sinus in the infrazygomatic crest region. Am J Orthod Dent Fac Orthop 2018; 153:656-661.

7. Park HS, Lee SK, Kwon OW. Group distal movement of teeth using microscrew implant anchorage. Angle Orthod 2005; 75:602-609.
8. Papadopoulos MA, Tarawneh F. The use of miniscrew implants for temporary skeletal anchorage in orthodontics: a comprehensive review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007; 103:e6-e15.
9. Nucera R, Lo Giudice A, Bellocchio AM, et al. Bone and cortical bone thickness of mandibular buccal shelf for mini screw insertion in adults. Angle Orthod 2017; 87:745-751.
10. Chen YJ, Chang HH, Lin HY, et al. Stability of mini plates and mini screws used for orthodontic anchorage: experience with 492 temporary anchorage devices. Clin Oral Implants Res 2008; 19:1188-1196.
11. Ghavat C, Bhola N, Agarwal A, et al. Reconstruction of mandibular defect using patient specific peek implant an approach to aesthetic reconstruction. Med Sci 2020; 24:1261–1266.
12. Park YC, Lee SY, Kim DH, et al. Intrusion of posterior teeth using mini screw implants. Am J Orthod Dentofacial Orthop 2003; 123:690-694.
13. Creekmore TD. The possibility of skeletal anchorage. J Clin Orthod 1983; 17:266-269.
14. Ottofy L. Standard dental dictionary. Laird and Lee, Chicago, 1923.
15. Daskalogiannakis J, Miethke RR, McNamara JA. Glossary of orthodontic terms. Chicago, London, 2000; 1.
16. Ismail SF, Johal AS. The role of implants in orthodontics. J Orthod 2002; 29:239-245.
17. Singh A, Sheokand V, Bhardwaj A, et al. Dental implant design an insight overview. J Med Pharm Allied Sci 10:3101–3105.
18. Ghoshal PK, Kamble RH, Shrivastav SS, et al. Radiographic evaluation of alveolar bone dimensions in the inter radicular area between maxillary central incisors as “safe zone” for the placement of mini screw implants in different growth patterns a digital volume tomographical study. J Evol Med Dent Sci 2019; 8:3836–3840.
19. Mangal K, Dhamande MM, Sathe S, et al. An overview of the implant therapy: The esthetic approach. Int J Curr Res 2021; 13:106–112.
20. Poggio PM, Incorvati C, Velo S, et al. “Safe zones”: a guide for mini screw positioning in the maxillary and mandibular arch. Angle Orthod 2006; 76:191-197.
21. Mallick R, Pisulkar SK, Reddy SG. Assessment of outcomes of immediately loaded dental implants in orofacial cleft patients: Protocol for a single arm clinical trial. JMIR Res Protoc 2021; 10:e25244.
22. Migliorati M, Benedicenti S, Signori A, et al. Mini screw design and bone characteristics: An experimental study of primary stability. Am J Orthod Dentfac Orthop 2012; 142:228-234.