CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2389147

Available online at: http://www.iajps.com ***Research Article***

MINISCREWS IN ORTHODONTICS

Ahmad abdulaziz Almulhim, Turki Mohamed A Alsubaie
Imam Abdulrahman Bin Faisal University

Abstract

Background: *An adequate anchorage is often challenging in orthodontics and dentofacial orthopedics. The ability to control all the aspects of tooth movement is limited. The inadequate mechanical system to control anchorage leads to anchorage loss of the reactive unit. The conventional; Extraoral (headgear) and Intraoral (transpalatal arch) anchorage system is doubtful in providing absolute anchorage. Therefore, the need for orthodontic treatment that maximizes anchorage control and minimizes patient compliance requirements has led to the development of implant-assisted orthodontics (Bone supported anchorage/ skeletal anchorage)*

The aim of work: *In this study, we aimed to understand advancement in orthodontics anchorage using miniscrew implants, the basic design of implant and classification, site of placement and risk factors associated.*

Methodology: *The review is using the comprehensive search of Pubmed in American Journal Orthod Oral Surg from 1945 to 1984, J Clin Orthodontics (1983), and European Journal Orthodontics (1999). The terms used for the search are: miniscrew implants, bone supported anchorage, classification, risk factors*

Result: *Using mini implants as a temporary anchorage device is a boon for an orthodontist, as there is no need for complicated clinical and laboratory procedures to facilitate safe and precise implant insertion. Miniscrews provide absolute anchorage, with the advantage of immediate loading when appropriate physiological forces are applied. Because miniscrew provides an alternative to conventional mechanics, the use of miniscrew has offered a wide variety of treatment alternatives, mainly while treating challenging cases. Further studies on the development of new design and miniscrew supported appliance in the orthopedic field is yet to be done.*

Keywords: *Miniscrew Implants, Bone Supported Anchorage, Classification*

Corresponding author:
Ahmad abdulaziz Almulhim ,
Imam Abdulrahman Bin Faisal University,
Email: F.b.i_ksa@hotmail.com
Mobail: 0506835578

QR code

Please cite this article in press Ahmad abdulaziz Almulhim et al., ***Miniscrews In Orthodontics.,*** *Indo Am. J. P. Sci, 2018; 05(12).*

BRIEF HISTORY:

The evolution of miniscrews started in 1945 when Grainsforth and Higley [1] placed Vitallium screws in ramus of 6 dogs to distalize maxillary canine. However, the initiation of force resulted in screw loss in 16 to 31days. Later, Creekmore and Eklund [2] evaluated that a small sized Vitallium bone screw could be inserted just below the anterior nasal spine to treat a patient with a deep impinging overbite. Roberts et al. [3] reported the osseous adaptations of rigid endosseous implants to continuous loading of 100 gms in rabbit femurs. Results indicated that titanium implants provided firm osseous anchorage for orthodontics and dentofacial orthopedics. Eugene Roberts [4] conducted extensive research on the use of retromolar implants for orthodontic anchorage. Park et al. showed that 1.2mm diameter microscrews could be inserted between the roots of the teeth to retract the six anterior teeth en mass and intrude mandibular molars at the same time [5].

METHODOLOGY:

- **Data Sources and Search terms**

We conducted this review using a comprehensive search of Pubmed in American Journal Orthod Oral Surg from 1945 to 1984, J Clin Orthodontics (1983), and European Journal Orthodontics (1999). The terms used for the search are: miniscrew implants, bone supported anchorage, classification, risk factors.

- **Data Extraction**

Two reviewers have independently reviewed the studies, abstracted data and disagreements were resolved by consensus. Studies were evaluated for quality and a review protocol was followed throughout.

The study was done after approval of the ethical board of King Abdulaziz University Hospital.

CLASSIFICATION:

Based on Location [6,7]	• Subperiosteal • Transosseous • Endosseous
Based on Configuration and design	• Root form Implants • Blade/Plate form Implants
According to composition	• Stainless steel, • Cobalt-Chromium, • Molybdenum, titanium, • Ceramic Implants. Miscellaneous such as Vitreous carbon and composites
According to insertion	• Threaded /Non –Threaded • Porous/ Non- porous
According to the mode of insertion	• Pre-tapped screws • Self-tapping screws • Self- drilling screws
Based on their origin [8]	• Osseointegrated • Surgical mini-implants
Cope classification [9]	• Biocompatible • Biologic in nature
According to the shape and size	• Conical (Cylindrical) • Miniscrew Implants • Palatal Implants • Prosthodontic Implants • Miniplate Implants • Disc Implants (Onplants)
According to implant and bone contact	• Osseointegrated, • Non-Osseointegrated.

Table1: Summary of classification of miniscrews [22]

DESIGN OF SCREW:

Creekmore and Eklund were the first orthodontists to suggest in print that a small metal screw could withstand a constant force of sufficient magnitude and duration to reposition an entire anterior maxillary dentition without becoming loose, painful, infected, or pathologic. The material used for miniscrew is medical grade 4 or 5 titanium, and stainless steel has been proposed as an alternative. The soft tissue healing is different with different head designs of miniscrew [2].

The conical screws used in Miniscrew Designs, made of medical grade 5 titanium, are available in three sizes .

Sizes	**Dimensions**	
	Length (mm)	Diameter (mm)
Type A	11mm	1.3 mm at neck and 1.1 mm at the tip
Type B	11mm	1.5mm at neck and 1.3mm at tip
Type C	11mm	1.5mm at neck and 1.3mm at tip

Table 2: Types of miniscrews based on diameter [22]

The most common design is button-like design with a sphere or double-sphere like shape or hexagonal shape. The implants available in this design is Aarhus Anchorage System (Fig.1), the Miniscrew Anchorage System, the Orthoanchor K1 System, and the Spider Screw (Fig.2), the IMTEC Mini Ortho Implant [10].

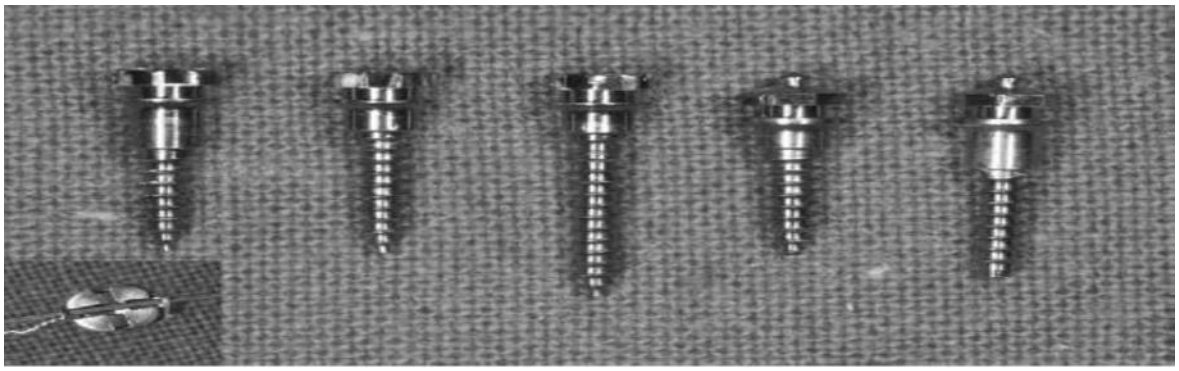

Fig.1: The Aarhus Anchorage System [22]

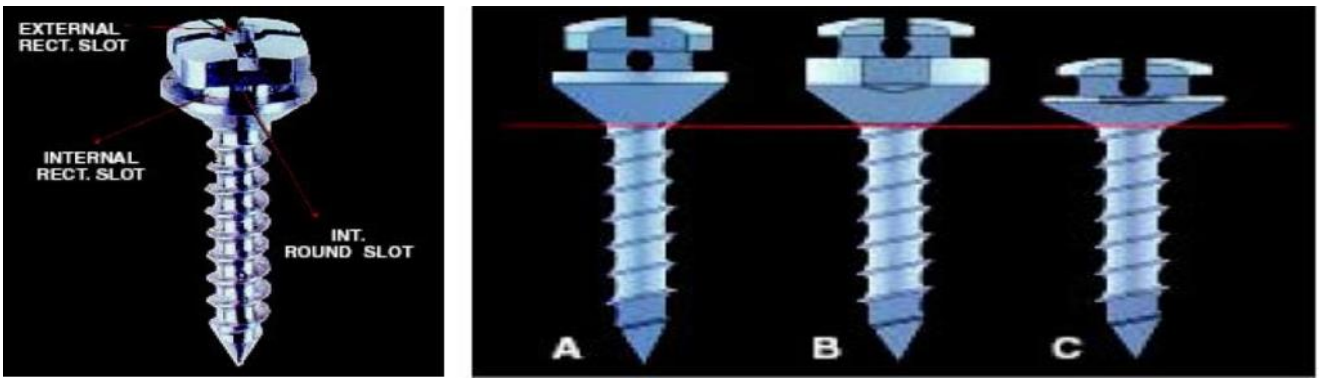

Fig.2: Different height of spider screw: A.-Regular, B.-Low profile, C.-Low profile flat [22]

Sites for miniscrew placement

Potential sites for miniscrew implant placement:

Maxilla: area below the anterior nasal spine, the palate (either on the midpalate or the paramedian palate), the infrazygomatic crest, the maxillary tuberosities, and the alveolar process (both buccally and palatally between the roots of the teeth) [10,12] as shown in Fig.3.

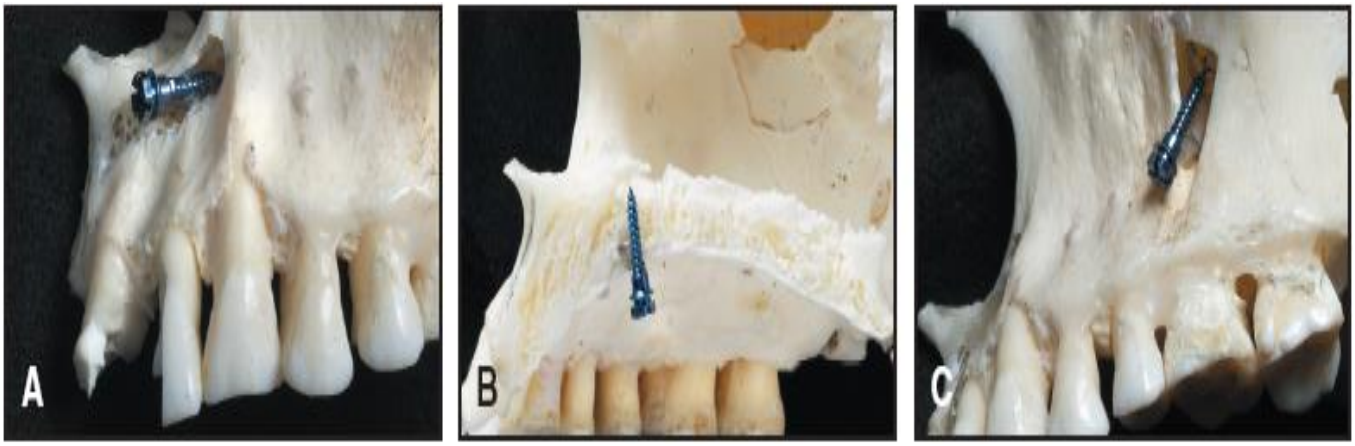

Fig.3: A- Below nasal spine, B- In the palate, C-Infrazygomatic crest [22]

Mandible: the symphysis or parasymphysis, the alveolar process (between the roots of the teeth), and the retromolar area as shown in Fig.4 [10, 11].

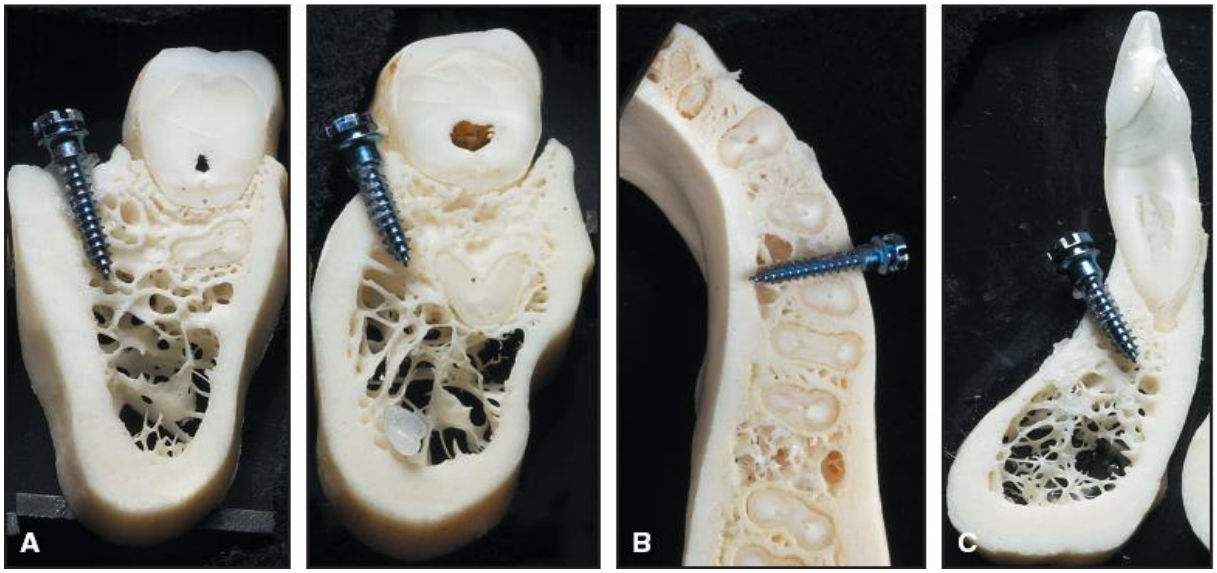

Fig.4: A- Retromolar area and molar region, B- Alveolar process, C- Symphysis [10]

A volumetric tomographic image study was done to assist the clinician in placing miniscrew in safe zones [11]. We have summarized in Table 3.

Interradicular spaces of the posterior maxilla (More anterior and more apical safer the location becomes)	**Intraradicular spaces of the mandible**
• On the palatal side, the interradicular space between first molar and second premolar and in between first and second molar premolar, 2-8mm and 2-5 mm above alveolar crest respectively. • On both buccal and palatal side between first and second premolar and between first premolar and canine, 5-11 mm from the alveolar crest. • On the buccal side, the interradicular space between first molar and second premolar, from 5-8mm above the alveolar crest	• Interradicular spaces between the first and second molar • Interradicular spaces between first and second premolar • Interradicular spaces between first molar and second premolar at 11mm from the alveolar crest • Interradicular spaces between first premolar and canine at 11mm from the alveolar crest

Table 3: Safe zones of miniscrews [23]

These are the statistical evaluation of data and do not eliminate the need for radiographic evaluation.

PREOPERATIVE EVALUATION:

Preoperative evaluation of miniscrew implant placement using CT or CBCT:

CT or CBCT should ideally be performed in all the orthodontic patients undergoing miniscrew implant placement. Panoramic, lateral, and frontal cephalometric radiographs may not provide all information needed to optimize the location of a miniscrew placement. However, lateral cephalometric radiographs enable accurate and reliable preoperative evaluations of bone quantity in the paramedian palate and palatal region [14,15]. The bone quality in these regions tends to be relatively high [16].

Melsen suggests the placement of miniscrew implants at and oblique angle, in an apical direction, maxilla and parallel to the roots in mandible [12]. According to **Kyung et al.** [13] miniscrew implants should be inserted at an angle of 30° to 40° to the long axes of the teeth in the maxilla, and 10° to 20° angulation in the mandible.

RISK FACTORS:

A meta-analysis reported the failure rate of miniscrew implants to be 0.123% [17] and clinical success rate in an implant- assisted orthodontics exceeds 80% [18]. The failure rate does not majorly differ by sex, insertion site or insertion side. However the failure risks are higher among younger patients (<20 years) due to active bone metabolism and low maturation of maxillofacial bone [19] and higher in the mandible than maxilla due to higher bone density and a smaller amount of cortical bone [20].

OTHER FACTORS:

The proximity of implant to a tooth root, root contacting during insertion, soft tissue inflammation, root resorption, local ischemia and delayed bone healing, Tobacco smoking, Diabetes, Juvenile Idiopathic Arthritis, Medication like Bisphosphonates, immune modulators, antiepileptics, anti-aggregation medication, and anticoagulants [21].

CONCLUSION:

The use of orthodontic miniscrew implants expands the envelope of discrepancies that are potentially correctable by orthodontic and dentofacial orthopedic treatment. However, the relative effectiveness and efficiency of miniscrew implants used for various clinical problems need further evaluation in prospective controlled studies. Of the many hypothesized factors in the failure rates of orthodontic miniscrew implants, most need further evidence to support their associations. However, the success rate of miniscrew implant placements is improved by CT or CBCT examinations of the dentomaxillofacial field and by technical improvements in the miniscrew implant placement procedure. Further technical advances in miniscrew implants for skeletal anchorage will require improved understanding of the associated orofacial biology and

implant-assisted orthodontic biomechanics.

REFERENCES:

1. **Geinforth BL, Higley LB (1945):** A study of orthodontic anchorage possibilities in basal bone. Am J Orthod Oral Surg., 31: 406-417
2. **Creekmore TD, Eklund MK (1983):** The possibility of skeletal anchorage. J Clin Orthod., 17: 266-269
3. **Roberts WE, Smith RK, Zilberman Y, Mozsary PG, Smith RS (1984):** Osseous adaptation to continuous loading of rigid endosseous implants. Am J Orthod., 86: 95-111
4. **Roberts WE, Markshall K J, Mozsary PG (1990):** Rigid endosseous implants utilised as anchorage to protract molars. Angle Orthod., 60: 135-152
5. **Park S, Bae SM, Kyung HM, Sung JH (2001):** Micro-implant anchorage for treatment of skeletal class I bialveolar protrusion. J Clin Orthod., 35(7): 417-422
6. **Wilmes B, Ottenstreuer S, Su YY, and Drescher D (2008):** Impact of implant design on primary stability of orthodontic miniimplants. J Orofac Orthop., 69:42-50,
7. **Melsen B and Costa A (2000):** Immediate loading of implants used for orthodontic anchorage. Clin Orthod Res., 3:23-28,
8. **Melsen B (2005):** Mini-implants: where are we? J Clin Orthod., 39:539-47.
9. **Cope J (2005):** Temporary anchorage devices in orthodontics: a paradigms hift. Semin Orthod., 11: 3-9.
10. **Moschos A Papadopoulos (2007):** The use of miniscrew implants for temporary skeletal anchorage in orthodontics: A comprehensive review. Oral Radiol Endod., 103:6-15.
11. **Poggio P, Incorvati C, Velo S, Carano A (2006):** Safe zones: a guide for miniscrew positioning in the maxillary and mandibular arch. Angle Orthod., 76:191-7
12. **Melsen B (2005):** Mini-implants: where are we? J Clin Orthod., 39:539-47.
13. **Kyung HM, Park HS, Bae SM, Sung JH, Kim IB (2003):** Developmentof orthodontic micro-implants for intraoralanchorage. J ClinOrthod., 37:321-8
14. **H Wehrbein, BR Merz, P Diedrich (1999):** Palatal bone support for orthodontic implant anchorage–a clinical and radiological study. Eur J Orthod., 21:65-70
15. **B.A. Jung, H. Wehrbein, L. Heuser, M. Kunkel (2011):** Vertical palatal bone dimensions on lateral cephalometry and cone-beam computed tomography: implications for palatal implants placement. Clin Oral Implants Res., 22: 664-668
16. **C.H. Kau, S. Richmond, J.M. Palomo, M.G. Hans (2005):** Current products and practice: three-dimensional cone beam computerized tomography in orthodontics. J Orthod., 32: 282-293
17. **MA Papadopoulos, SN Papageorgiou, IP Zogakis (2011):** Clinical effectiveness of orthodontic miniscrew implants: a meta-analysis. J Dent Res., 90: 969-976
18. **SK Chuang, L Tian, LJ Wei, TB Dodson Kaplan-Meier (2001):** analysis of dental implant survival: a strategy for estimating survival with clustered observations. J Dent Res., 80: 2016-2020
19. **M Motoyoshi, T Yoshida, A Ono, N Shimizu (2007):** Effect of cortical bone thickness and implant placement torque on stability of orthodontic mini-implants. Int J Oral Maxillofac Implants. 22: 779-784
20. **Y Chen, HM Kyung, WT Zhao, WJ Yu (2009):** Critical factors for the success of orthodontic mini-implants: a systematic review. Am J Orthod Dentofacial Orthop., 135: 284-291
21. **Hostie S, Vercruyssen M, Quirynen M, Willems G (2008):** Risk factors and indications of orthodontic temporary anchorage devices: a literature review. AOJ., 24:140-148
22. **Padmini M N et al. (2016):** Mini Screws as Temporary Anchorage Device in Orthodontics: A Narrative Review. IOSR Journal of Dental and Medical Sciences, 15: 55-56
23. **Poggio P, Incorvati C, Velo S, Carano A (2006):** Safe zones: a guide for miniscrew positioning in the maxillary and mandibular arch. Angle Orthod., 76:191-7