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# An Overview on Mini-screws Compliance as Anchorage Unit in Orthodontic Practice

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## ABSTRACT

In contemporary orthodontics intrusion of posterior molars without the extrusion of anterior dentition is quite challenging but with the help of temporary anchorage devices like miniscrews it becomes relatively easier for an orthodontist to achieve the good treatment results. Orthodontic anchorage is one the important factor for orthodontic treatment to be successful and conventional orthodontic appliances like headgear and intra-oral elastics are usually used but now a days mini implants are being utilized as skeletal anchorage devices instead of convention orthodontic appliances. According to recent studies relatively higher number of patients are choosing miniscrews over extraction of teeth although very few had previous knowledge of mini-implants. According to many orthodontist, miniscrews were easier to place and enhanced the orthodontic treatment procedures and results. The prime purpose of using mini-implants as temporary anchorage because they provide support through osseointegration. Because of close contact between bone and implant junction osseointegration takes place. Beside many advantages there are also fewer disadvantages of using miniscrews as anchorage devices such as higher cost, scar formation, technique sensitive, and longer duration required for osseointegration. Miniscrews can be utilized for various orthodontic treatment procedures intrusion of dentition, retraction of anterior dentition, individual tooth extrusion or intrusion. It helps in intrusion of dentition without the extrusion anchorage teeth. In prosthetic procedures when intrusion or extrusion of teeth is required miniscrews can be used. There are also few complications reported after miniscrew placement like trauma to surrounding tissues, infection, peri-implantitis, inflammation, orthodontic loading affecting stationary anchorage resulting in its failure, soft tissue covering the miniscrew head area. The main aim of this review was to enlighten the types, advantages, disadvantages and acceptance of miniscrews in field of orthodontics.

**Key Words:** Miniscrews, Temporary anchorage devices, Skeletal anchorage, Intrusion, Extrusion, Retraction

## INTRODUCTION

Orthodontic treatment focus on providing the patient with better dentofacial functions and esthetic thus improving the patients well being. Resistance to unwanted tooth movement is defined as anchorage and it is an important factor for providing stable orthodontic treatment results[1]. To obtain orthodontic anchorage, traditional orthodontic appliances like headgear and intra-oral elastics are generally used but in contemporary orthodontics mini implants are being used as skeletal anchorage devices without the use of intra-oral elastics and headgear. Utilization of temporary anchorage devices(TAD's) for providing skeletal anchorage has been extensively integrated into orthodontic practice for increasing the perimeter of tooth movement without the patient acquiescence [2,3,4].

Malocclusions associated with vertical skeletal pattern such as open bite and over eruption of teeth are usually treated with TAD,s[5,6]. Treatment time required for orthodontic correction with TAD's is considerably longer but it has an advantage of lesser irreversible damage and conservative treatment approach [7]. TAD's are enough to treat almost all types of malocclusion if designed correctly except few facial deformities which requires extensive surgical procedures to acquire balanced surgical relationship[8]. In orthodontics there various types TAD's are utilized[9]. Conventional osseointegrated implants was reported by Turley et al.[1] and Roberts et al.[10]. Palatal implants was reported by Wehrbein et al.[11] whereas, mini-implants and micro implants was reported by Freudenthaler et al.[12] and Costa et al.[2].

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The objective of this paper is to enlighten the uses, types, advantages and disadvantages of miniscrews which are utilized to acquire temporary but complete anchorage for orthodontic operation.

### Perception of patient and orthodontist for utilization of miniscrews.

In contemporary orthodontics utilization of miniscrews are becoming more common because of its capability to provide adequate anchorage and also it decreases the need of patient conformity during orthodontic procedure[13]. According to few studies, considerably high number of patients (86.7%) selected miniscrews over extraction even though only very few(12.7%) had the previous knowledge of miniscrews[14]. Hence, this proves that patients conformity is not necessary in placements of miniscrews and it promotes the successful orthodontic treatment with better results, without the need of extraction[14]. The study carried out according to Gunduz et al. after the placement of palatal implants patients complained of difficulty in eating, difficulty in speaking and injury to tongue[15]. Few patients also complained of pain, swelling and cheek irritation but there were not many reports of same complaints. For successful outcome of miniscrews oral hygiene also plays an important factor, one of the important factor for success rate of miniscrew is avoidance of inflammation of peri-implant tissue reported by Miyawaki et al[16]. According to the orthodontists miniscrews were easy to use and abridged orthodontic procedures.

### Mini implants in orthodontics

Since long period in dentistry titanium implants has been widely used. Osseointegration takes place at the bone and implant junction because of the close contact and interaction of bone and implant which resembles ankylosis[17]. The use of dental implants as anchorage devices are extensively used in orthodontics because they provide support through osseointegration. Initially few limitations were noted as mini implants were being utilized in orthodontics such as higher cost, adversity in discarding mini implant after finishing the orthodontic treatment, invasive surgery, longer time period required for osseointegration, scar formation after removal of the implant[18,19]. Conventional implants are placed on edentulous sites and can have adequate bone for anchorage of the implant but orthodontics patients are usually younger in age and does not have edentulous sites hence this was one of the prime difficulties faced by orthodontist initially when implants were introduced. To address this difficulty orthodontic mini implants were introduced which was nothing but titanium implants with smaller dimensions(mini-screws)[20].

Basically there are two main systems of mini-implants miniscrews and miniplates. The attachment of miniscrews are only to cortical bone where as the attachment of miniplates is to infrazygomatic crest and the other end has appendages

to enwrap orthodontic auxiliaries. Therefore, miniplates has direct bone anchorage and because of this higher loading force are applicative to miniplates when compared to miniscrews[21]. Miniscrews can be placed in various sites such as buccal alveolus, palatal bone, retromandibular triangle and inter-radicular spaces. But there is often failure of the miniscrews after placement in the inter-radicular area as there is a limited space available because of neighbouring root[22]. Because of keratinized mucosa, rootless area, low risk of injury to blood vessel and alleviation of accession the palatal area is favorable for placement of miniscrews[23]. According to few studies the longer length of the miniscrews higher is the success rate but it also has disadvantage of injury to adjacent anatomical areas. For the safe placement of miniscrews the recommended length was around 6mm-8mm by Deguchi *et al*[24]. But Tseng *et al.* in his studies found that there was 100% success rate for miniscrews of length equal to or longer than 12mm[25]. There was also correlation between the success rate of miniscrews and site of the placement like there was reports of 24% higher success rate when placed in attached gingival than movable mucosa. According to few studies when miniscrews placed on keratinized gingival there is less probability of inflammation and tissue hyperplasia thus making it more evident that it is advisable to place the miniscrews in keratinized gingival[26]. The surgical placement of miniscrews like raising a flap or flapless placement was also correlated with success rate of it. There was higher success rate for miniscrews placed by flapless procedure as reported by Kuroda *et al.*[27] but contrary to this finding flapless procedures showed lower success rate according to Hermann *et al.*[28]. The loading time for miniscrews ranges from 1 to 14 months. The highest failure rate of miniscrews occurred during the first 100-145 days after the placement of miniscrews according to Wiechmann *et al.* [29]. But there were reports of most of the miniscrews failures occurring during the first 4 months after its placement according to Moon *et al.*[30] findings.



**Figure 1:** Miniscrew placed in the interradicular region of maxillary left first molar and second molar on attached gingival for retraction of anterior dentition.

## Uses of miniscrews

### A. Intruding the dentition

Skeletal anchorage provided by miniscrews for intrusion of the dentition helps in providing necessary movement without anchorage teeth getting extruded. According to one study carried out by Creekmore and Eklund [31] intrusion of central incisors was done by 6mm with utilization of miniscrews. In another study carried out by Ohnishi *et al.*[32] in 2005 gummy smile correction was done by intrusion of central incisors by 3.5mm. In few case reports counterclockwise mandibular rotation was also achieved with along with intrusion of molars by 3 to 5mm[33].

### B. Retraction of anterior dentition

Retraction of anterior teeth can be done by utilization of miniscrews. According to a case reported by Park *et al.*[34] in which utilization of brackets was not required for retraction of anterior dentition with innovational miniscrew technique. Thiruvengkatachari *et al.*[35] carried out a split-mouth prospective study in canine retraction was done with loss of anchorage on the non implant side and implant side had no loss of anchorage.

### C. Individual teeth intrusion or extrusion

For replacement of teeth by prosthetic appliances it usually requires intrusion of teeth in the opposing arch by orthodontic correction. In prosthetic restoration of lower missing molars the intrusion of upper molars can be done buccally and palatally before the prosthetic restoration begins[36]. There have been also reports of two cases in which utilization of braces was not done on the other teeth and miniscrews were used for intruding the upper and lower molars which were over erupted[37].

## Complications of orthodontic miniscrews

### A. Infection, peri-implantitis and inflammation of soft tissue

After placement of few miniscrews peri-implantitis, tissue inflammation and minor infection usually occurs[38]. There are reports of 30% failure rate directly associated with peri-implant tissue inflammation after the placement of miniscrews. If the mucosa around the implants shows signs like bleeding on probing, epithelial infiltration, loss of bone and mobility it is called peri-implantitis[39]. During the placement of the miniscrew if around its shaft there is a twisting of soft tissue, the practitioner should be cautioned. Because of possibility of this complication before the placement of orthodontic load to miniscrews few clinicians encourage 2 weeks time period for soft tissue healing[40].

### B. Trauma to surrounding tissue

In some cases during the insertion of miniscrews trauma to

the surrounding tissues like periodontal ligament can occur which in turn results in dentoalveolar ankylosis, osteosclerosis and non-vital tooth this mainly happens due to inter-radicular placement of the miniscrews[41]. But after the removal of miniscrews the damage done by it to periodontal ligament is completely reversible within the time period of 12 to 18 weeks after its removal. The orthodontist should do the proper examination before the placement of miniscrews in the inter-radicular spaces by utilizing peri-apical radiographs and panoramic radiographs to avoid trauma[42]. To assess the approximation of miniscrews with periodontal ligament the clinician should observe patient's sensation to pain if topical anesthesia is administered in such situation the miniscrew cease to its position or requires more strength for insertion the clinician should do radiographic examination after stopping the insertion and followed by unturning it by 2 or 3 turns[43].

### C. Miniscrew's coverage by soft tissue

It is a point of concern for orthodontist if miniscrew get covered by soft tissue after its placement and it may also concern the patient who may think that it has fallen. The coverage of miniscrew may happen mostly in the area of miniscrew head and its auxiliaries like elastic chain and coil spring, it occurs due to packing and aggravation of adjacent movable alveolar mucosa. This coverage of miniscrews usually happens in mandibular area[44]. An elastic separator, a wax pellet or abutment can be used to arrest the overgrowth of soft tissue, chlorhexidine can also be utilized to slow down soft tissue epithelialization also inflammation is minimized.

### D. Orthodontic loading resulting in failure of stationary anchorage.

The factors such as design of miniscrew, surgical placement, force load on miniscrew, density of bone and soft tissue around the miniscrew are responsible its stability during the treatment. It is advisable to uninstall the miniscrew if it get loosen during the treatment because of its inability to regain its stability[45]. If the cortical bone thickness is comparatively inadequate it results in stationary anchorage failure and adequate bone density is the key factor for stability of miniscrew. According to few studies stationary anchorage failure ranges from 11%-30% [46]. Placement of miniscrews in nonkeratinized alveolar mucosa usually has greater failure rates therefore, the most suitable site for its placement is the area with thin keratinized tissue like midpalatal or dentoalveolar region [47]. There is more mechanical grip like screw-bone contact with self drilling miniscrew when compared with self tapping miniscrew. According to many studies if the loading force is more or less 300g it can provide greater stability to miniscrew [48].

## Conclusion

In summary, mini-implants can be utilized as mini-plates and miniscrews and many studies stated that miniscrew are more readily accepted by patients and orthodontist. Miniscrews provide adequate skeletal anchorage required for single or multiple teeth movement without altering orthodontic treatment procedures. It gives better treatment results esthetically and functionally but besides all these advantages it also has few disadvantages like technique sensitivity, scar formation, inflammation to the surrounding area. Further studies for improving soft tissue healing is required.

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## Conflict of interest

The authors have no conflict of interest

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