

A Review on Mandibular Buccal Shelf Miniscrew

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Abstract: Buccal shelf area of mandible is a recent addition to temporary anchorage device proposed by John Jin-Jong Lin and Chris Chang, in 2010. Anatomically Buccal shelf is located bilaterally in the posterior part of the mandibular body, buccal to the roots of the first and second molars and anterior to the oblique line of the mandibular ramus and is a very safe site for extra radicular temporary anchorage devices because of increased cortical bone thickness and density. There is a positive association between primary stability of implant and cortical bone thickness. CBCT helps to quantify the skeletal anatomy of the buccal shelf, placement angle of the TADs, and amount of cortical bone engagement at the TAD interface.

Keywords: Mandibular buccal shelf; Miniscrew; Cortical bone thickness; CBCT.

INTRODUCTION

Class III malocclusion with mild to moderate skeletal discrepancy can be camouflaged by orthodontic treatment alone to obtain a good and stable result. Extraction of lower premolars can be done to retract lower anterior teeth and achieve a Class I canine relationship. However, there are circumstances where extraction cannot be done, such as missing permanent teeth and minor discrepancy etc. The entire mandibular arch distalization is another option to correct a Class III relationship. However, it is considered one of the most difficult tooth movements in orthodontics. The development of temporary anchorage devices (TADs), has increased the effectiveness of lower arch distalization. These screws can be placed at different sites, such as the retromolar area, inter radicular area, and ramus of the mandible.

Buccal shelf area of the mandible (MBS)

Recently Chris Chang et al. suggested the Buccal shelf area of the mandible (MBS) as a novel area for the insertion of TAD which is considered as effective site as compared to the other sites as the implant is placed extra radicular, which will not

interfere with distalization and has got sufficient bone thickness, thus reduces the implant failure. MBS is bilaterally located buccal to the roots of the first and second mandibular molars and anterior to the oblique line of the mandibular ramus, and it is covered with the thickest cortical bone in the mandible [1].

Factors influence the success of miniscrews

Although the TADs are temporary and must be removed once their objective has been achieved, their stability is important for a successful function. Factors that influence the success or failure of miniscrews could be classified into patient-related factors (age, sex, skeletal pattern, and oral hygiene), miniscrew-related factors (diameter, length, and shape of the device), and treatment-related factors (technique, forces applied to the miniscrews, and their insertion site).

1. Cortical bone thickness

The stability of miniscrews does not depend on Osseo-integration; rather, it depends on mechanical retention due to the interaction between the miniscrew surface and the surrounding bone. This interaction is known as primary stability, and satisfactory primary

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stability requires an anatomical region with specific characteristics in terms of bone density, depth, thickness, and adequacy. However, variations in the depth and thickness of the bone along its course may affect miniscrew placement.

MBS has a good cortical bone thickness and it helps in greater stability due to its higher modulus of elasticity, increased resistance to deformation, and higher load-bearing capacity in clinical situations than trabecular bone. Inaba and Park *et al.* suggested placing the TAD at an angle to the bone surface to increase bone contact [2, 3]. At MBS miniscrew can be placed in different angulation as it is an extra alveolar site. Kolge *et al.* showed that the cortical bone thickness significantly increased in more apical areas. Ono *et al.* measured the cortical bone thickness between first and second mandibular molars at 15 vertical heights with a 1mm interval and reported the cortical bone tended to be thicker as move apically [4]. However, Deguchi *et al.* angulated the TAD at 45° and did not find a significant difference in the buccal cortical bone thickness at the occlusal level and apical level. When it is considering the insertion angulation there is a significant increase in cortical bone thickness when it is parallel to the long axis of the molar. Chang *et al.* found that an increase of 0.66 – 1.00 mm when comparing 0° and 30° and it is statistically significant. There is a slight reduction when it changes from 20° to 30° [5].

2. Root proximity

Contact of miniscrew with root is considered one of the most frequent causes of failure. The placement technique focuses on minimal root damage during screw placement. Park *et al.* suggested placing the screws at an obtuse angle to the bone surface to increase bone contact and lower the risk of root damage. Placing the devices in an extra alveolar site like the MBS permits the use of larger-diameter screws that can be inserted parallel to the axial inclination of molars and not interfere with tooth roots. Therefore, to avoid root contact with miniscrew during insertion or distalization, a distance of at least half of the diameter of TAD plus the periodontal ligament space width, which was 1.21mm (rounded up to 1.5mm), should be available [3].

3. Mandibular nerve proximity

As the anatomical structures associated with the buccal shelf, the relationship of the inferior alveolar nerve to the miniscrew has to be evaluated. The ability to digitally trace the nerve will help the clinician to determine the insertion path and decrease the probability of violating the nerve. According to Greenstein *et al.* a clearance of 2mm from the nerve is considered safe for the insertion of implants. Elshebiny

et al. found that the screws had the greatest proximity to the nerve at the distal aspect of the second molar in the MBS site and there also ample safe distance was present [6, 7].

CONCLUSION

The most suitable position for implant insertion can be buccal to the mesial and distal cusp of the second molar as there is enough cortical bone thickness for the stability of the implant. As insertion depth increases both cortical bone thickness and root clearance are increases. The implant can be placed parallel to the long axis of the tooth adjacent to it as it gives more cortical bone engagement and enough clearance from the root. There is sufficient clearance from the mandibular nerve in all sites and depth at all angulation, so implant insertion is safe at MBS.

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