ISSN: 1110-435X
ONLINE ISSN: 281-5258

Egyptian
Orthodontic Journal

EVALUATION OF BONE THICKNESS OF THE MANDIBULAR BUCCUL SHELF IN DIFFERENT AGE GROUPS FOR MINI-SCREW INSERTION

Osama A. Ezz El-Regal[1], **Abbadi A. El-Kadi**[2], **Waleed E. Refaat**[3]

Abstract

Introduction: The mandibular buccal shelf has been presented lately, as an available extra-alveolar mini-screw insertion site, which 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 specially at the buccal bone lateral to the distal root of the second molar, with screw insertion located 4 mm buccal to the CEJ.

The objective: was to evaluate the bone thickness of the mandibular buccal shelf in different age groups for mini- screw insertion by using CBCT digital radiographs.

Methods: 90 CBCT digital records were selected randomly and were grouped according to age. Each group contains 30 CBCT digital records as follows: Group A: with age from 14 to 18 years old. Group B: with age from 19 to 23 years old. Group C: with age from 24 to 28 years old. then quantitative bone characteristics of the mandibular buccal shelf of bone were evaluated.

Results: showed that no statistically significant differences between all age groups at all the sites. Conclusion: Mandibular buccal shelf offers optimal sites for the insertion of mini-screw.

Keywords:

Anchorage, Mini-Screw, Mandibular Buccal Shelf, Cortical Bone Thickness.

INTRODUCTION: Anchorage methods were introduced in orthodontics to prevent undesired, unplanned, or unwanted tooth movement during orthodontic treatment of malocclusions. Absolute anchorage that can completely prevent the movement of the anchor tooth unit also allows better control on the teeth in anteroposterior, lateral, and vertical directions. Mini-screws for the first time were described as intraoral skeletal anchorage devices for orthodontic use that allow the orthodontist to apply absolute anchorage.[1, 2]

Factors that can affect mini-screws success can be classified into three categories: patient factors, MSIs factors, and technique factors. Examples of patient factors that can affect mini-screws success rate: Cortical bone thickness and density that considered as the most important patient determinants of primary stability.

Primary stability was found to be one of the important factors for a successful mini-screw placement in addition to bone quality and

[1] Teaching Assistant At Faculty Of Dentistry Sinai University
2 Professor Of Orthodontics, Dean Of Faculty Of Dentistry, King Salman International University
3 Professor Of Orthodontics, Head Of Orthodontics Department, Faculty Of Dentistry, Suez Canal University

quantity at the site of placement[3] So, differences in primary stability could be found because of variation in both anatomical sites cortical bone quantity and quality and also due to individual variations.

Different sites have been used for mini-screw insertion: buccal and palatal maxillary inter radicular alveolar bone between dental roots, the median palatine raphe, the anterior palate, the mandibular buccal inter radicular alveolar bone between dental roots, the infrazygomatic crest, and the mandibular retromolar area.

The mandibular buccal shelf has been presented lately, as an available extra-alveolar mini-screw insertion site, which 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, especially at the buccal bone lateral to the distal root of the second molar, with screw insertion located 4 mm buccal to the CEJ.[4, 5]

OBJECTIVES: Evaluation of bone thickness of the mandibular buccal shelf in different age groups for mini-screw insertion by using CBCT digital images.

METHODS: 90 CBCT digital records were selected from the digital archive of CBCT x-ray machine in the Oral Radiology Department of Faculty of Dentistry, Suez Canal University and were found to fulfill the criteria of selection, and were grouped according to age. Each group contains 30 CBCT digital records as follows: Group A: 14 to 18 years old .Group B: 19 to 23 years old .Group C: 24 to 28 years old.

Quantitative evaluation protocol of mandibular buccal shelf bone was done for each subject by OnDemand3DApp Project Viewer Limited software. Three preliminary reference lines were reoriented according to the following method [6]1-The axial view scan plane was reoriented to pass through (Two furcation point of the right and left mandibular first molar and furcation point of the right mandibular second molar). 2-The sagittal view scan plane was reoriented to follow two points at the center of dentoalveolar process the first point at the level of the mesial root of mandibular first molar and the distal root of the mandibular second molar. 3-The coronal view scan plane was reoriented to fit the long axis of the coronal 2/3 of the four roots of first and second mandibular molar.

After reorientation, the coronal view section of (Mesial and Distal roots) of the permanent mandibular second molars in both sides of the mandible were investigated. Evaluation of quantitative bone characteristics of the mandibular buccal shelf of bone were done: A) vestibular cementoenamel junction was identified. B) Evaluation of total bone thickness = the cortical bone plus the medullary bone (mm). This measurement will be taken on two horizontal reference lines apically located. 1st horizontal reference line at 6 mm apically from CEJ. 2nd horizontal reference line at 11 mm apically from CEJ. C) Evaluation of Total depth = cortical bone plus medullary bone (mm). These measurements will be taken on two vertical reference lines buccally located. 1st vertical reference line will be located at 4 mm buccal to CEJ. 2nd vertical reference line will be located at 6 mm buccal to CEJ

RESULTS & DISCUSSION:

Total thick at 6mm	Group A (n = 30)	Group B (n = 30)	Group C (n = 30)	F	p
R 2M -m	2.09±4.42	3.67 ± 1.54	3.01 ± 1.59	4.781*	0.011*
Significance Between Groups	p_1=0.235, **p_2=0.007***, p_3=0.320				
R 2M -d	2.14±6.58	1.93±5.96	2.25±5.23	3.073	0.051
L 2M -m	1.87±4.51	1.32±4.02	1.56±4.02	0.946	0.392
L 2M -d	2.20±6.42	1.40±6.39	1.75±6.32	0.021	0.979

No statistically significant differences between all age groups at all the sites except at: Total bone thickness value at the mesial root of the Right second molar measured on the horizontal reference line at 6 mm apical to the CEJ; there was a statistically significant difference where group A showed higher results than group C. however, This difference is thought to be meaningless in clinical practice because all values recorded at this site in all groups were less than the minimum horizontal bone thickness for MIS insertion (5 mm), so This site was found not suitable for MISs insertion,

Total depth at 4mm	Group A (n = 30)	Group B (n = 30)	Group C (n = 30)	H	p
R 2M -m	7.71±13.88	7.12±14.35	8.80±12.56	0.245	0.885
R 2M -d	6.34±17.82	4.94±19.02	5.85±18.24	0.531	0.767
L 2M -m	6.24±14.60	3.82±17.28	3.18±18.55	7.033*	0.030*
Significance Between Groups	p_1=0.109, **p_2=0.009***, p_3=0.303				
L 2M -d	5.30±19.43	3.08±20.46	2.46±21.52	5.941	0.051

Total bone depth value at the mesial root of the left second molar measured on a vertical reference line at 4 mm buccal to the CEJ and at the distal root of the left second molar measured on a vertical reference line at 6 mm buccal to the CEJ; there was a statistically significant difference where group C showed higher results than group A in both sites. This significant difference might be explained by allometry Changes in functional capacity, Age-related differences, maximum bite forces, and muscle activity all tend to increase with age.

All MBS total bone thickness measurements at the distal root sites are higher than the mandibular second molar's mesial root sites. All MBS total bone depth Measurements at the distal root sites are higher than the mandibular second molar's mesial root sites. These results suggested that the closer the MISs are inserted to the molar, the greater the bone depth will be found, allowing longer MISs to be used and higher primary stability.

CONCLUSION: There were no statistically significant differences between all age groups at all the sites except at the mesial root of the right second molar total bone thickness at 6 mm apical to the cementoenamel junction, the mesial root of the left second molar total bone depth at 4 mm buccal to the cementoenamel junction and the distal root of the left second molar at 6 mm buccal to the cementoenamel junction .Mandibular buccal shelf offers optimal sites for the insertion of mini screw implants according to its osseous characteristics .The mandibular buccal shelf's insertion site with the optimal anatomic characteristics is the buccal bone lateral to the second molar's distal root, with screw insertion located 4 mm buccal to the cementoenamel junction .Mini screw implant insertion sites should always be evaluated individually because of anatomical variation among individuals. Pre-drilling is recommended to avoid high insertion torque, according to the mandibular buccal shelf's cortical bone thickness.

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