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ASSESSMENT OF BONE DEPTH AT INFRAZYGOMATIC CREST FOR MINI-SCREW INSERTION

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ABSTRACT

Introduction/Background: The infrazygomatic crest is considered an important area for a successful mini-implant insertion. The objective of this research is to gain a better understanding of the infrazygomatic crest anatomy for a safe and efficient placement of mini-implants.

Materials and methods: A total of 26 CBCT scans from adult patients were analyzed. Reconstructed CBCT axial slice was used to precisely identify the apex of the mesiobuccal root, distobuccal root, and furcation of each permanent first maxillary molar and to analyze bone depth above each root.

Results: The highest average bone depth was located just above the apex of the mesiobuccal (MB) root and the distobuccal (DB) root with an average values of 12.24 mm and 12.31 mm respectively.

Conclusion: The best bone depth was available above the root apices of the mesiobuccal and distobuccal roots. It is essential to acknowledge the significant anatomical differences at the infrazygomatic crest among individuals, highlighting the importance of personalized approaches in orthodontic treatments.

KEY WORDS: Infrazygomatic, Mini-implant, Mini-screw, Bone depth.

INTRODUCTION

Miniscrews, also known as temporary anchorage devices (TADs), have revolutionized orthodontic treatment by offering a stable and reliable source of anchorage for tooth movement without relying on adjacent teeth. The infrazygomatic crest (IZC), located in the upper jaw near the zygomatic bone, is one of the most frequently chosen sites for

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miniscrew placement due to its proximity to the maxillary arch and its relatively predictable bone structure. This area has proven to be a favorable location for miniscrew insertion since it offers both accessibility and sufficient bone support for stable anchorage.

However, the success of miniscrew placement at the infrazygomatic crest is highly dependent on several anatomical factors, the most critical of which is the bone depth in this region. Adequate bone depth ensures sufficient primary stability for the miniscrew, which is necessary to resist the mechanical forces applied during orthodontic treatment. Inadequate bone depth can lead to a lower insertion torque, resulting in a higher likelihood of screw failure, loosening, or even complete expulsion from the bone. Conversely, excessive bone depth may lead to difficulties during insertion and the need for specialized techniques or instruments.

Previous studies have shown that the bone thickness at the infrazygomatic crest can vary considerably between individuals. For example, research has found that the average bone depth at the IZC ranges between 3 - 5 mm in many adult patients, but the variability across different populations and individual characteristics can be substantial (Xie et al., 2019; Lee et al., 2021). Factors such as age, gender, ethnicity, and individual anatomical differences can significantly influence the bone thickness at this site. In younger individuals, for example, the bone may be more cortical and denser, offering better stability for screw placement, whereas older patients may experience a reduction in bone density due to age-related changes, potentially affecting the success of miniscrew insertion.

Recent advances in imaging technology, particularly cone-beam computed tomography (CBCT), have greatly enhanced the ability to assess the bone morphology with precision. CBCT provides three-dimensional views of the bone, allowing clinicians to evaluate the exact bone depth and quality in this region before screw placement. This enables more accurate planning and increases the likelihood of successful insertion by identifying areas of sufficient bone depth and avoiding regions that may present risks due to inadequate bone thickness.

Understanding the bone depth at the infrazygomatic crest is essential for optimizing miniscrew placement, as it directly impacts the mechanical stability and long-term success of the miniscrews. Clinicians must consider not only the general anatomical features of the IZC but also patient-specific factors that can influence bone depth and quality. Therefore, the aim of the current study was evaluation of the Infrazygomatic bone depth for the ideal position of orthodontic miniscrew placement.

MATERIAL AND METHODS

Ethical approval for the study was granted by the Ethical Committee of the Faculty of Dentistry, Cairo University.

The study sample consisted of 26 CBCT scans from adult patients, each with a maxillofacial field of view of 200 x 170 mm and a voxel size of 0.4 mm (400 µm). These scans were obtained from the Oral and Maxillofacial Radiology Department at the Faculty of Dentistry, Cairo University.). The inclusion criteria for selecting CBCT scans were patients aged 20 - 40 years with an intact maxillary jaw, in which the second bicuspids, first molars, and second molars were present. Exclusion criteria were the presence of progressive periodontal disease, genetic syndromes, history of facial trauma or orthognathic surgery, as well as conditions such as clefts, sinus pneumatization, fractures, syndromes, or lesions.

CBCT scans were imaged using the Planmeca Promax 3D MID CBCT machine, located at the outpatient clinic of the Oral and Maxillofacial Radiology Department, Faculty of Dentistry, Cairo University. The scans varied in field of view according to the patients' needs, but all included posterior maxillary views with a voxel size of 0.4 mm.

The Digital Imaging and Communications in Medicine (DICOM) files were imported into Invivo Dental 3D software (version 5.3.1, Anatomage, San Jose, CA) for measurement. The axial section was navigated to display the upper first molar as a reference landmark (Figure 1).

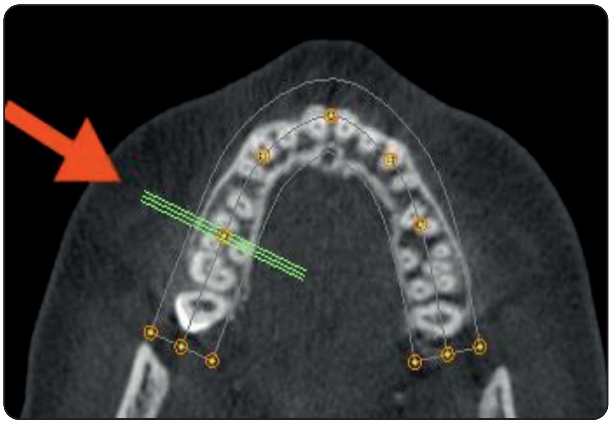

Fig. (1): Orientation of cuts in the axial plane.

For the analysis, five depth measurements were taken along three horizontal lines corresponding to the mesiobuccal root, furcation, and distobuccal root of the first molar (Figure 2).

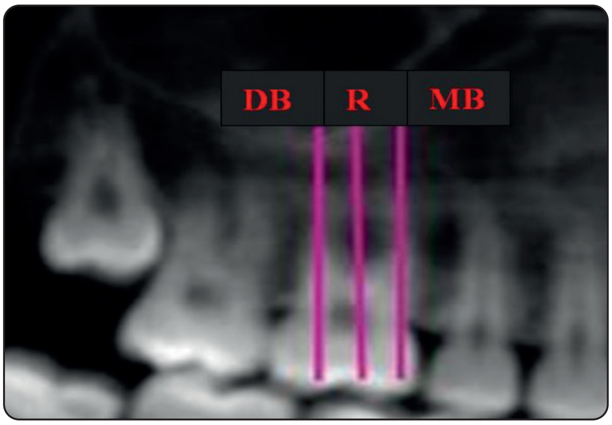

Fig. (2): Orientation of cuts in the sagittal plane.

The reconstruction of the slices was conducted at three specific locations on the maxillary first molar, chosen for their anatomical relevance in evaluating the surrounding bone structure. Each slice was oriented to be perpendicular to the buccal bone surface and parallel to the long axis of the molar. This orientation was carefully selected to ensure that the measurements accurately reflected the relationship between the buccal bone surface and any vital structure as palatal cortical bone , maxillary sinus and the palatal root of the first molar.

The three chosen locations for slice reconstruction are shown in (Figure 3)

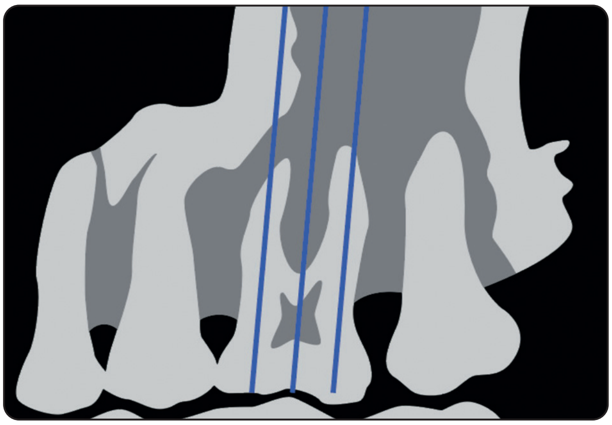

Fig. (3): Illustration of the three areas for cross sectional cuts.

1. **Root tip of the mesiobuccal root of the maxillary first molar (MB)**: The mesio-buccal root was selected as the first site for slice reconstruction.
2. **Middle of the buccal furcation of the maxillary first molar (R)**: The furcation was selected as the second site for slice reconstruction. The furcation is the region where the roots diverge from the crown of the molar. The measurement at this location was taken at the point equidistant between the mesial and distal buccal roots where the distance between them was 2.5 mm or more .

3. **Root tip of the distobuccal root of the maxillary first molar (DB)**: The disto-buccal root was selected as the third site for slice reconstruction.

At each of these locations, five depth measurements were recorded. The depth measurements assessed the relationship between the buccal bone surface and the boundaries of the available osseous space, which included the cranial, lingual, and caudal borders.

Measurements for the bone depth above mesio-buccal root, furcation and distobuccal root

MB1: The 1st horizontal measurement for the bone depth just above mesiobuccal root apex.

MB2: The 2nd horizontal measurement for the bone depth 1mm above MB1.

MB3: The 3rd horizontal measurement for the bone depth 1mm above MB2.

MB4: The 4th horizontal measurement for the bone depth 1mm above MB3.

MB5: The 5th horizontal measurement for the bone depth 1mm above MB4.

R1: The 1st horizontal measurement for the bone depth where the width of the furcation is 2.5 mm or more.

R2: The 2nd horizontal measurement for the bone depth 1mm above R1.

R3: The 3rd horizontal measurement for the bone depth 1mm above R2.

R4: The 4th horizontal measurement for the bone depth 1mm above R3.

R5: The 5th horizontal measurement for the bone depth 1mm above R4.

DB1: The 1st horizontal measurement for the bone depth just above distobuccal root apex.

DB2: The 2nd horizontal measurement for the bone depth 1mm above DB1.

DB3: The 3rd horizontal measurement for the bone depth 1mm above DB2.

DB4: The 4th horizontal measurement for the bone depth 1mm above DB3.

DB5: The 5th horizontal measurement for the bone depth 1mm above DB4.

Depth Measurement Procedure:

Each site followed a consistent protocol to ensure accurate and reliable bone depth measurement from the buccal cortical bone to the palatal cortical bone or any vital structure as the maxillary sinus, nasal floor and the palatal root

Sites 1 and 3 (MB (Figure 4) **and DB** (Figure 5)): At both of these sites, the first depth measurement was recorded perpendicular to the buccal bone surface and tangent the root tip of the respective mesio-buccal or disto-buccal root. Following the initial measurement, the next four measurements were made apically at 1mm intervals, ensuring that all measurements were taken perpendicular to the buccal bone surface. This systematic method allowed for a precise mapping of the osseous space above the root tips, offering a comprehensive view of the bone structure as it extends away from the root.

Site 2 (R) (Figure 6): The first depth measurement at this site differed slightly in approach. The measurement was taken at the point where the furcation width reached at least 2.5 mm, which is significant because this is the minimum inter-radicular distance required for the insertion of a mini-screw with a 1.5 mm or smaller diameter. Mini-screws of this size are commonly used in orthodontic treatments, and the 2.5 mm width ensures sufficient space for safe insertion without compromising the integrity of the roots. Following this first measurement, the subsequent four depth measurements were taken in the same manner as at sites 1 and 3, with each measurement taken 1 mm cranially from the previous one.

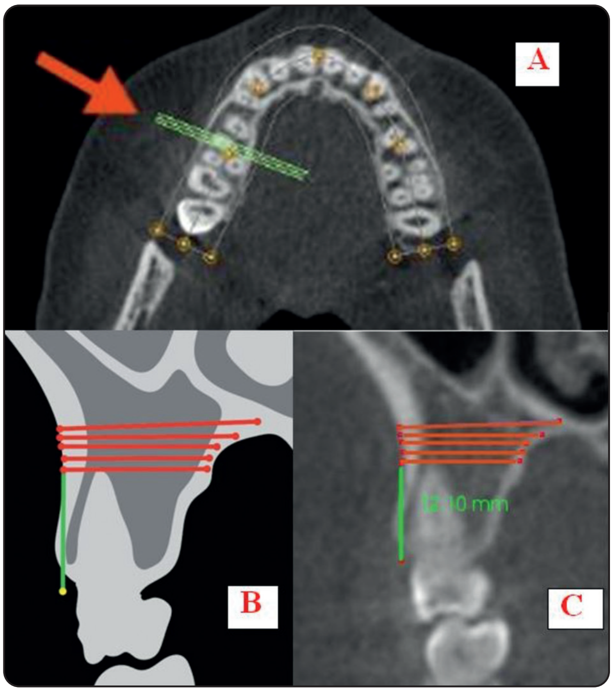

Fig. (4): Measurements related to site 1 (mesiobuccal root) : (A) Axial view showing mesiobuccal root . (B) Illustration showing bone depth measurements related to mesio-buccal root. (C) Coronal view of the mesiobuccal root on which bone depth measurements were measured.

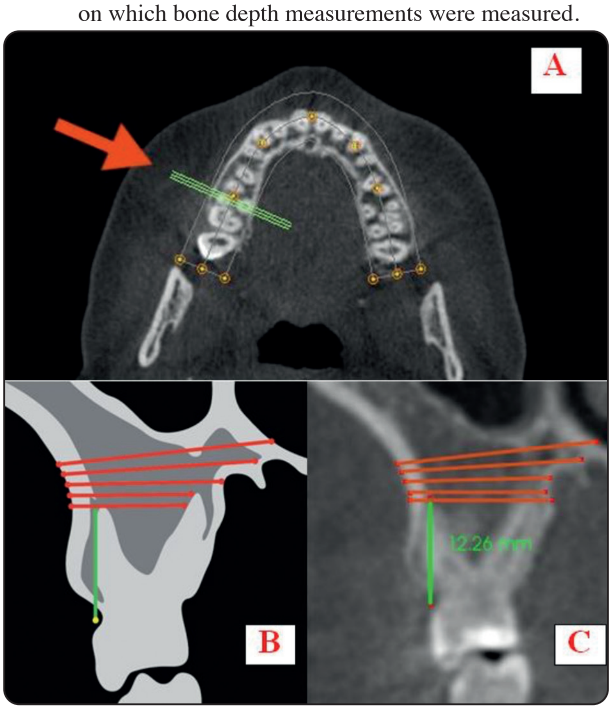

Fig. (5): Measurements related to site 3 (distobuccal root) : (A) Axial view showing distobuccal root . (B) Illustration showing bone depth measurements related to distobuccal root. (C) Coronal view of the distobuccal root on which bone depth measurements were measured.

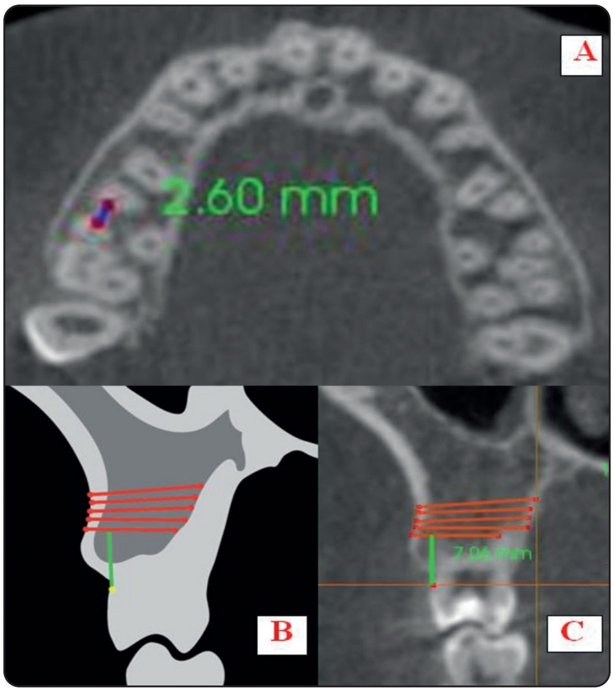

Fig. (6): Measurements related to site 2 (furcation area) : (A) Axial view showing furcation root where the distance between the mesiobuccal and distobuccal roots was 2.5 mm or more . (B) Illustration showing bone depth measurements related to furcation area. (C) Coronal view of the furcation area on which bone depth measurements were measured.

Ensuring Measurement Reliability:

Ten percent of the measurements were repeated twice with a two-week interval to gather data for assessing intra-rater reliability. Additionally, 10% of the cases were selected for the inter-observer reliability assessment.

RESULTS

1. Mesiobuccal root (MB): Comparison between MB1, MB2, MB3, MB4, MB5.

Comparison between different measurements was performed by using the One-Way ANOVA test, which revealed a significant difference between them as P=0.004, followed by Tukey`s Post Hoc test for multiple comparisons, which revealed that: MB1(12.24±2.86) and MB2 (11.66±3.21) significantly demonstrated the greatest depth, but

MB5 (8.05 ± 4.76) significantly demonstrated the least depth, while MB3 (10.98 ± 3.94) and MB4 (10.42 ± 5.26) demonstrated insignificant difference with all other measurements (Table 1, Figure 7).

2. Furcation (R): Comparison between R1, R2, R3, R4, R5. The minimum, maximum, mean, and standard deviation of R1, R2, R3, R4, R5, and overall, regarding depth measurements above furcation were presented in table 2.

Comparison between different measurements was performed by using the One-Way ANOVA test, which revealed an insignificant difference between them at P=0.21 (Table 2 and Figure 8).

TABLE (1) Descriptive results of depth measurements above the mesiobuccal root, comparison between MB1, MB2, MB3, MB4, and MB5 using One Way ANOVA test followed by Tukey`s Post Hoc test for multiple comparisons:

MD Depth	Minimum	Maximum	Mean	Standard Deviation	P value
MB1	6.21	20.42	12.24 [a]	2.86	0.004*
MB2	7.17	21.18	11.66 [a]	3.21	
MB3	4.06	20.18	10.98 [ab]	3.94	
MB4	1.70	24.20	10.42 [ab]	5.26	
MB5	1.04	20.19	8.05 [b]	4.76	
Overall	5.95	17.10	10.67	3.09	

***Significant difference as P<0.05.**

Means with different superscript letters were significantly different as P<0.05.

Means with the same superscript letters were insignificantly different as P>0.05.

TABLE (2) Descriptive results of depth measurements above furcation, comparison between R1, R2, R3, R4, and R5 using One Way ANOVA test followed by Tukey`s Post Hoc test for multiple comparisons:

R Depth	Minimum	Maximum	Mean	Standard Deviation	P value
R1	6.31	13.80	8.69 [a]	1.72	0.21NS
R2	5.72	14.57	8.83 [a]	2.22	
R3	4.46	15.80	9.25 [a]	2.78	
R4	4.06	16.85	9.93 [a]	3.56	
R5	3.84	20.70	10.36 [a]	4.15	
Overall	5.34	16.34	9.41	2.73	

NS: non-significant difference as P>0.05.

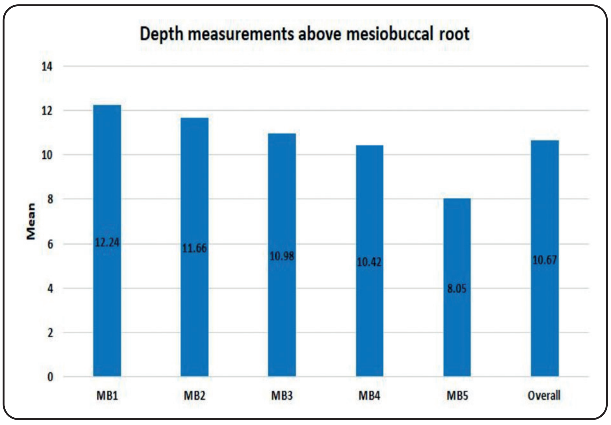

Fig. (7): Bar chart showing depth measurements above the mesiobuccal root.

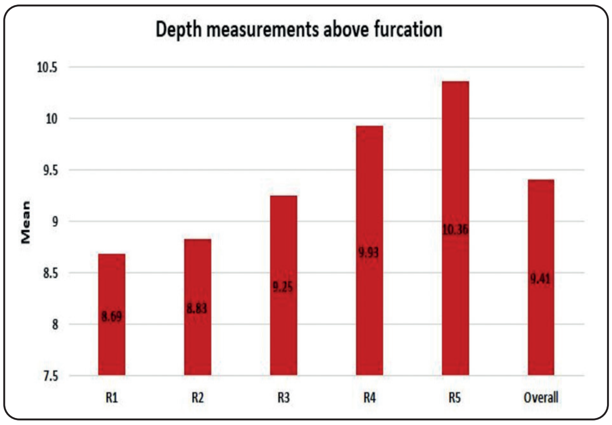

Fig. (8): Bar chart showing depth measurements above furcation.

3. Distobuccal root (DB): Comparison between DB1, DB2, DB3, DB4, DB5.

Comparison between different measurements was performed by using the One-Way ANOVA test, which revealed a significant difference between them as P=0.0001, followed by Tukey`s Post Hoc test for multiple comparisons, which revealed that: DB1(12.31 ± 3.54) and DB2 (10.07 ± 4.58) significantly demonstrated the greatest depth, but DB4 (7.25 ± 5.11) and DB5 (5.96 ± 2.09) significantly demonstrated the least depth, while DB3 (9.6 ± 5.97) demonstrated insignificant difference with all other measurements (Table 3, Figure 9).

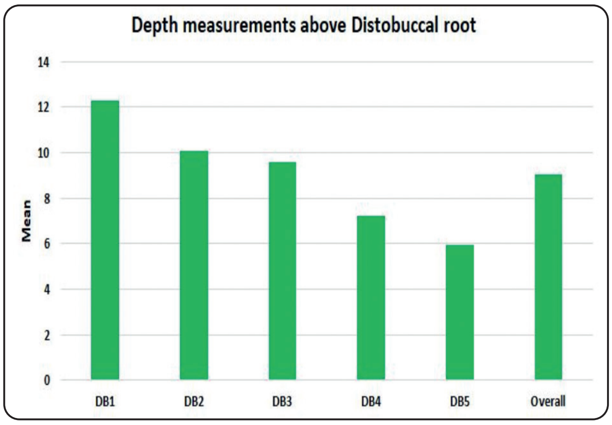

Fig. (9) : Bar chart showing depth measurements above the distobuccal root.

Table (3) : Descriptive results of depth measurements above Distobuccal root, comparison between DB1, DB2, DB3, DB4, and DB5 using One Way ANOVA test followed by Tukey`s Post Hoc test for multiple comparisons:

DB Depth	Minimum	Maximum	Mean	Standard Deviation	P value
DB1	5.57	20.02	12.31 ^{a}	3.54	
DB2	2.96	17.97	10.07 ^{a}	4.58	
DB3	2.32	20.85	9.60 ^{ab}	5.97	0.0001*
DB4	1.88	20.59	7.25 ^{b}	5.11	
DB5	1.30	22.81	5.96 ^{b}	5.09	
Overall	3.31	18.31	9.04	3.62	

Significant difference as P<0.05.

Means with different superscript letters were significantly different as P<0.05.

Means with the same superscript letters were insignificantly different as P>0.05.

4. Comparison between Mesiobuccal root (MB), Buccal furcation (R), and Distobuccal root (DB): Mean and standard deviation of bone depth above MB1, MB2, MB3, MB4, and MB5 regarding mesiobuccal root, and R1, R2, R3, R4, R5 regarding buccal furcation, and DB1, DB2, DB3, DB4, DB5 regarding distobuccal root were presented.

Comparison between different measurements was performed by One Way ANOVA test, which revealed a significant difference between them as P<0.0001, followed by Tukey`s Post Hoc test for multiple comparisons, which revealed that:

The greatest bone depth was demonstrated in MB1 (12.24 ± 2.86), MB2 (11.66 ± 3.21), MB3 (10.98 ± 3.94), R1 (8.69 ± 1.72), R2 (8.83 ± 2.22), R3 (9.25 ± 2.78), R4 (9.93 ± 3.56), R5 (10.36 ± 4.15), DB1 (12.31 ± 3.54), DB2 (10.07 ± 4.58), DB3 (9.6 ± 5.97), with insignificant difference between them. On the other hand, **the least bone depth** was demonstrated in MB5 (8.05 ± 4.76) and DB5 (5.96 ± 5.09).

Comparison between Mesiobuccal root (MB), Buccal furcation (R), and Distobuccal root (DB) regarding overall measurements of 5 points was performed and revealed insignificant difference between them as P=0.15 (Table 4, Figure 10).

Table (4): Bone depth above MB1, MB2, MB3, MB4, and MB5 regarding mesiobuccal root, and R1, R2, R3, R4, R5 regarding buccal furcation, and DB1, DB2, DB3, DB4, DB5 regarding distobuccal root, comparison between them using One Way ANOVA test followed by Tukey`s Post Hoc test for multiple comparisons:

All measurements	Mean	Standard Deviation	P value
MB1	12.24 a	2.86	<0.0001*
MB2	11.66 a	3.21	
MB3	10.98 a	3.94	
MB4	10.42 ac	5.26	
MB5	8.05 b	4.76	
R1	8.69 a	1.72	
R2	8.83 a	2.22	
R3	9.25 a	2.78	
R4	9.93 a	3.56	
R5	10.36 a	4.15	
DB1	12.31 a	3.54	
DB2	10.07 a	4.58	
DB3	9.6 a	5.97	
DB4	7.25 bc	5.11	
DB5	5.96 b	5.09	
MB (average of MB1, MB2, MB3, MB4<MB5)	10.67	3.09	0.15
R (average of R1, R2, R3, R4, R5)	9.41	2.73	
DB (average of DB1, DB2, DB3, DB4, DB5)	9.04	3.62	

Significant difference as P<0.05.** ***Means with different superscript letters were significantly different as P<0.05.
Means with the same superscript letters were insignificantly different as P>0.05.

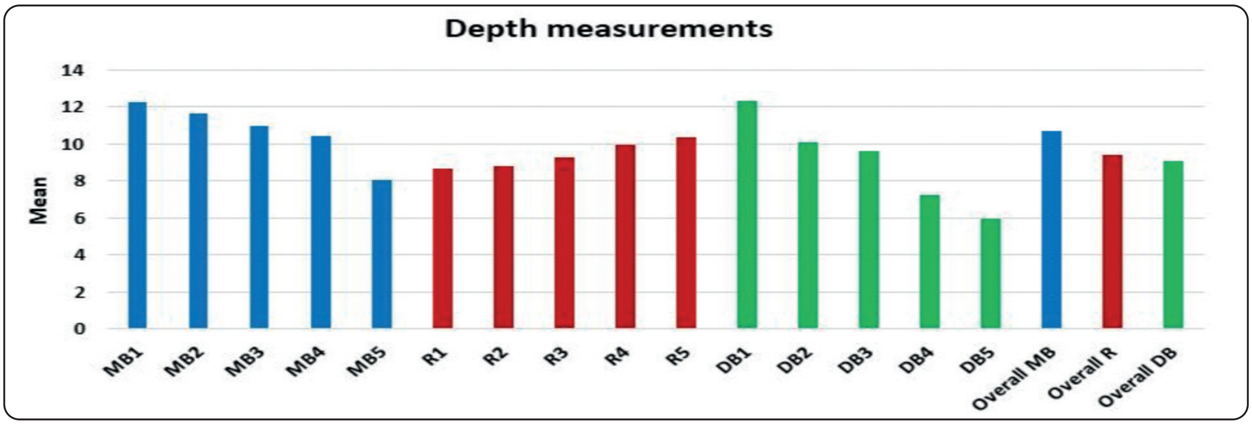

Fig. 10: Bar chart showing the comparison between depth measurements above Mesiobuccal root (MB), Buccal furcation (R), and Distobuccal root (DB).

Reliability: Intra-observer reliability (Inter Class Coefficient) was used to evaluate the agreement between 2 readings of the same observer and revealed excellent agreement (α = >0.9) in-depth, thickness, and vertical measurements as presented in the following tables.

DISCUSSION

The infrazygomatic region, located beneath the zygomatic arch, has gained attention as a viable site for miniscrew insertion, especially in cases where traditional anchorage methods are not feasible. However, assessing bone thickness in this area poses significant challenges due to its complex anatomy and the proximity of critical structures. The infrazygomatic bone may offer clinical advantages over traditional dento-alveolar interradicular mini-screw sites. One such advantage is the reduced risk of screw-to-root contact during various dental movements, as this contact is a common cause of failure. Given that most manufacturers provide mini-implants of varying lengths, with the shortest being 6–7 mm, and screws for miniplate fixation ranging from 4 to 7 mm in length, there is a potential risk of perforating the maxillary sinus, depending on the thickness of the infrazygomatic crest.

To ensure the safe and appropriate placement of implants, it is essential to understand the anatomy of the infrazygomatic crest through specific imaging techniques, such as CBCT. This study aimed to examine the thickness of the infrazygomatic crest across different patients, using CBCT imaging to measure bone depth. By exploring the variability in infrazygomatic bone thickness above the root apices of the first molar, this research will contribute to a more comprehensive understanding of bone depth in the region relevant to miniscrew placement. Ultimately, the findings of this study will provide evidence-based data to support clinical decision-making, enhancing the safety and predictability of miniscrew insertion in the infrazygomatic region.

The study sample consisted of 26 CBCT scans from patients aged 30 ± 10 years, collected from the Oral and Maxillofacial Radiology Department at Cairo University's Faculty of Dentistry. The sample size was approximately similar to that of the study by Baumgaertel & Hans (2009), which included 29 participants.

Radiographic examinations were performed using the Planmeca Promax 3D Mid CBCT machine, which offers several advantages, including automatic patient movement correction, ultra-low dose imaging, comprehensive imaging software, and versatile imaging options. The scans were conducted using various fields of view, all with a consistent voxel size of 0.4 mm (400 µm).

The Digital Imaging and Communications in Medicine (DICOM) file format was imported into Invivo Dental 3D software (version 5.3.1, Anatomage, San Jose, CA), as described by Weissheimer et al. (2012). This powerful yet user-friendly software facilitates accurate treatment planning by providing fast and high-quality rendering and visualization of Cone Beam 3D scans.

The focus of the analysis was the infrazygomatic crest above the upper first molar, based on the work of Aline Rode Santos et al. (2017) and Baumgaertel & Hans (2009). The apex of the mesiobuccal root, distobuccal root, and the furcation of the permanent first maxillary molar were identified using a sagittal slice, allowing for a cross-sectional view of these three primary landmarks associated with the upper first molar, as noted by Guo (2015).

In their 2017 study, Aline Rode Santos and her team performed two measurements: the first was 2 mm above the distobuccal root and the other was 2 mm above the first measurement. Baumgaertel and Hans (2009) conducted a more detailed analysis of the infrazygomatic crest by taking five measurements above each of the mesiobuccal root, the furcation, and the distobuccal root. This more thorough approach conducted for our analysis.

Slices were reconstructed at three sites, oriented perpendicular to the buccal bone surface and parallel to the long axis of the maxillary first molar, ensuring a standardized and reliable method of measurement for all cases, as recommended by Deguchi et al. (2006).

Using the mesiobuccal and distobuccal root slices, five depth measurements were taken to examine the relationship between the buccal bone surface and the cranial, lingual, and caudal borders of the available osseous space. This analysis aimed to evaluate the infrazygomatic bone depth at various levels above the root apices, as described by Baumgaertel & Hans (2009).

For the furcation slices, five additional depth measurements were taken to explore the relationship between the buccal bone surface, the cranial, lingual, and caudal borders of the available osseous space and the palatal root. These measurements were performed at levels where the distance between the mesiobuccal and distobuccal roots is 2.5 mm or greater, ensuring that the region under consideration provides sufficient space for miniscrew placement.

In a prior study assessing mini-screw stability, Liou et al. (2004) found that the average movement of an orthodontic mini-screw at the implant head was approximately 0.5 mm. Based on these findings, Maino et al. (2005) recommended a minimum safety distance of 0.5 mm from any adjacent anatomical structure. To reflect an ideal scenario, the present study adopted 0.5 mm as the safety distance, in line with current recommendations in the literature. When determining the minimal interradicular distance, the outer-core diameter of the implant must also be considered. For a mini-screw with a 1.5 mm diameter, the minimal interradicular distance should therefore be 2.5 mm. This is why measurements at the furcation area were taken where the distance between the mesiobuccal and distobuccal roots is at least 2.5 mm.

According to the results of our study, the greatest bone depth at the mesiobuccal root was observed at MB1, averaging 12.24 ± 1.72 mm apical to the cementoenamel junction (CEJ) of the maxillary first molar. The depth gradually decreased further apically. These findings closely align with those of Baumgaertel and Hans (2009), who reported an average of 12.18 ± 1.76 mm at the same level. Similarly, for the distobuccal root, the maximum bone depth was at DB1, with a measurement of 12.26 ± 1.87 mm from the CEJ, and it also decreased as it extended apically. These results are consistent with Baumgaertel and Hans (2009), who reported the maximum bone depth at a distance 11.9 ± 1.39 mm from the CEJ.

However, these maximum bone depth levels are not ideal for miniscrew insertion, as they are too close to the root apex, potentially affecting tooth vitality. Therefore, we recommend placing miniscrews 1 mm above these levels, where sufficient clearance is available.

In this study, the average bone depths measured were 10.67 ± 3.09 mm above the mesiobuccal root, 9.41 ± 2.93 mm above the furcation area, and 9.04 ± 3.62 mm above the distobuccal root. These values contrast with the results of Baumgaertel et al. (2009), who reported bone depths of 4.91 ± 4.1 mm above the mesiobuccal root, 5.19 ± 3.83 mm above the furcation area, and 4.27 ± 4.8 mm above the distobuccal root. Aline Rode Santos et al. (2017) reported an average infrazygomatic bone depth of 2.39 mm.

The differences in bone depth measurements across studies can be attributed to factors such as maxillary sinus pneumatization and individual anatomical variations. According to Ya Qiong Zhang et al. (2019), sinus pneumatization occurred in 50.7% of cases in the area of the first and second molars, while Evren Ok et al. (2014) reported an incidence of 39.8%. In our study, we excluded cases with obvious maxillary sinus pneumatization, which may explain why our bone depth measurements were higher than those in previous studies.

The first measurement, taken tangent to the root tip, would violate the minimum safety distance and is therefore not recommended for miniscrew insertion. Further apically, where sufficient clearance exists, bone depth decreases rapidly, increasing the likelihood of maxillary sinus perforation, even when using the shortest available orthodontic miniscrews. Thus, the recommended site for miniscrew insertion is 1 mm above the root apex of the mesiobuccal and distobuccal roots. For the furcation area, miniscrew insertion is not recommended due to the risk of interference with the palatal root and difficulty placing the screw between the mesiobuccal and distobuccal roots.

The high standard deviation observed in this study indicates significant individual variation in bone depth and cortical bone thickness in the region of interest. Therefore, CBCT imaging is essential prior to infrazygomatic miniscrew insertion to ensure safe and accurate placement.

CONCLUSIONS

Based on the results of the current study, the following conclusions can be drawn:

The deepest bone depth was recorded just above the root tip of both the mesiobuccal and distobuccal roots, with average measurements of 12.24 mm and 12.31 mm, respectively. Additionally, the bone depth decreased as we moved apically.

CLINICAL RECOMMENDATIONS

Based on the conclusions of the current study, the following recommendations can be made:

1. The optimal bone depth for miniscrew insertion in the infrazygomatic region is found 1 mm above the root apex of both the mesiobuccal and distobuccal roots.
2. The anatomical features of the infrazygomatic region exhibit considerable individual variation, making maxillary CBCT imaging essential for successful infrazygomatic miniscrew insertion.

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