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Assessment of optimal sites for inter radicular placement of mini-implant using CBCT – Part - I

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Abstract

Introduction: The influence of bone quality on the long-term success of oral implants is undisputed and has been known for over a decade. Bone quality can be expressed as the ratio of cortical to trabecular bone. Knowledge of the buccal cortical bone thickness in various areas can guide clinicians in selecting the placement site and the proper placement protocol. It is known that the quantity (bone volume) and quality (bone density) of alveolar bone are important factors for the stability of implants. The purpose of the present investigation was to determine the optimal sites of mini-implant placement in the anterior and posterior maxilla and mandible.

Materials and Methods: 50 CBCT images were collected from the archives in the age group of 15-30 years having a full complement of permanent teeth in both maxillary and mandibular arch. Inter radicular cortical bone thickness in the maxilla and mandible in the following site was measured a) Between central incisors b) Between premolars c) Between 2nd premolar and 1st molars. Measurement was virtually done on a

computer at two different depths from the cemento enamel junction that is 5mm and 10mm for maxillary arch and 5mm and 7mm for mandibular arch.

Results: The thickness increase as the cut move apically from 5mm to 10mm except in maxillary premolar palatal region and mandibular central incisor region.

Conclusions: Placement of mini-implant is crucial and is largely dependent upon the bone availability and its thickness. This CBCT study will help the clinician to overcome the previously encountered difficulties by showing light on the better-quality bone available for mini-implant placement.

Keywords: Anchorage, Cortical plate, Cone Beam Computed Tomography, Mini implant.

Introduction

Graber defined anchorage as the nature and degree of resistance to displacement offered by an anatomic unit when used for the purpose of effecting tooth movement[2]. Achieving maximum anchorage has always posed a great challenge in orthodontics. Conventional means of supporting anchorage have been used by either intraoral site or relying on extra oral means. Osseo integrated implants are considered a reliable source of anchorage in orthodontics. But the large size of these implants limits their usage.

To overcome this problem, mini-implants were developed[5]. Mini implants are being considered an absolute source of skeletal orthodontic anchorage[3] and provide reliable three-dimensional anchorage which leads to predictable treatment outcomes and less reliance on patient cooperation. Mini implants have gained enormous popularity in the orthodontic community because of their ease of placement and removal, low cost, and minimal/no need of patient compliance[3]. Because mini-implants may be immediately loaded, they require adequate primary stability followed by a consolidating period of secondary stabilization[4].

Stability of mini-implants is essential before it can be used for different treatment modalities[3]. Mini implants are used for specific time periods, mostly relying on mechanical retention, and do not always osseointegrate[5]. Primary stability is regarded as the key indicator of success and varies according to several patient, mini-implant design, and clinical technique factors. The most important patient factors affecting primary stability appears to be the density and depth of the cortical bone[4]. The current trend seems to be either blind placement of the mini-implant or the use of a periapical radiograph of the potential anchorage site. Neither of these methods offer adequate information for the predictable placing of mini-implants. Two-dimensional imaging does not offer adequate information regarding the inter radicular space, root morphology, thickness of cortical bone.

Hence, Three-dimensional imaging is an important diagnostic tool in the assessment of potential sites for mini-implant placement and can contribute significantly in predictable placement of mini-implants. Three-dimensional imaging of the potential placement site can help with preoperative planning and preparation. Conventional 3D imaging using multi-slice computed tomography (CTs) delivers a large radiation dose, which has discouraged orthodontists from routinely using this imaging technique. The development of cone-beam computed tomography (CBCT) has changed the imaging paradigm[3].

A limited number of studies have investigated cortical bone thickness in the maxilla and the mandible. Most of these studies have been carried out on a small sample or were limited to the posterior part of the jaws[1]. The purpose of the present investigation was to determine the

optimal sites of mini- implant placement in the anterior and posterior maxilla and mandible.

Methodology

50 CBCT images were collected from the archives of department of oral medicine and radiology, Rajarajeswari dental college and hospital, Bangalore, India in the age group of 15-30 years having a full complement of permanent teeth in both maxillary and mandibular arch.

Exclusion Criteria

- Overlapping of the crown or root of adjacent teeth
- Periodontal disease
- Severe ectopic eruption
- Missing teeth (excluding third molars)
- Mixed dentition or incomplete crown eruption

Inter radicular cortical bone thickness in the maxilla and mandible in the following site were measured

a) Between central incisors

b) Between premolars

c) Between 2nd premolar and 1st molars

Measurement was virtually done on a computer, using ONDEMAND 3D software version 5.2.6.

The following measurements were recorded at two different depths from the cementoenamel junction, that is 5mm and 10mm for maxillary arch and 5mm and 7mm for mandibular arch.

- Mesio distal distance: these measurements were taken both buccally and palatally/lingually at the widest distance between each two adjacent teeth (Figure 2)
- Buccolingual thickness: the thickness was measured from the outermost point on the buccal side to the outermost point on the palatal/lingual side, at the middle of the distance between each two adjacent teeth (Figure 3)
- Cortical bone thickness: the distance between the internal and external aspect of the cortex in the middle of the inter radicular distance between each two adjacent teeth both buccally and lingually/palatably (Figure 4)

Comparisons were performed using Student's paired t test.

Figure 1: Soredexscanora® 3d CBCT machine

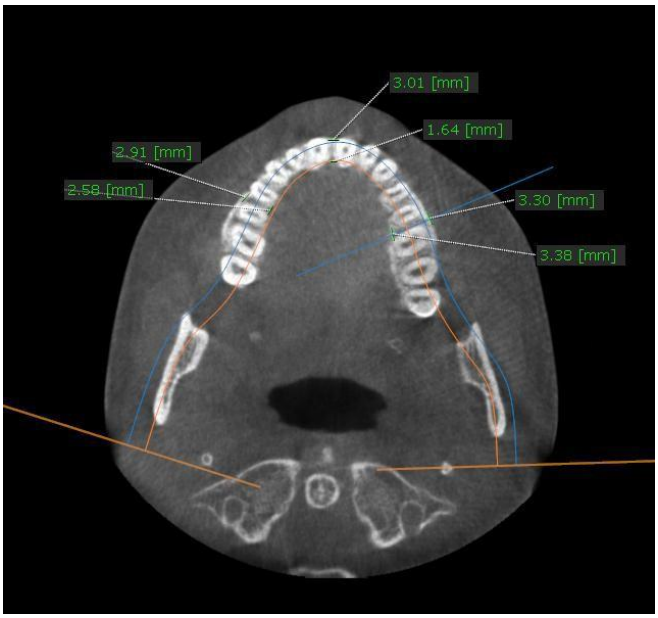

Figure 2: Mesiodistal Measurement at the widest distance between adjacent teeth.

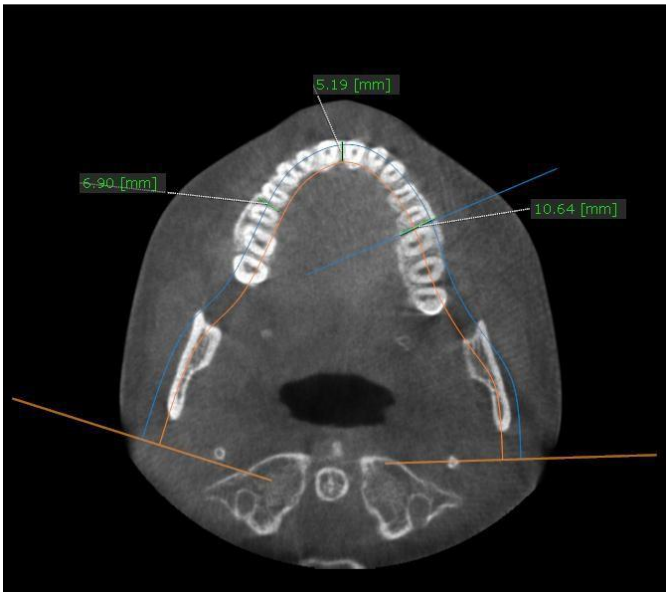

Figure 3: Buccolingual width measurement

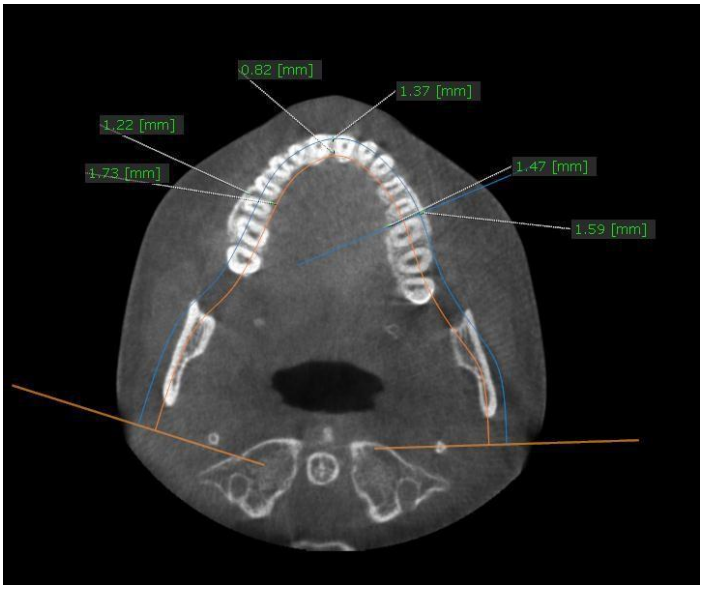

Figure 4: Measurement of buccal and lingual cortical bone thickness

Results

Comparison of mean cortical bone thickness in maxilla

Table 1: In maxillary CI region the buccal cortical bone thickness is relatively more at 10mm height which is not statistically significant, mean cortical bone thickness in lingual is significantly more at 10mm with p=0.001. In both 5mm and 10mm lingual was significantly thicker than buccal with p<0.001

Comparison of mean Cortical Bone thickness in Max. Central Incisor region b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.470	0.426	-0.003	-0.033	0.97
	10 mm	50	1.473	0.415			
Lingual	5 mm	50	1.921	0.620	-0.256	-3.554	0.001*
	10 mm	50	2.176	0.892			
5 mm	Buccal	50	1.470	0.426	-0.451	-7.704	<0.001*
	Lingual	50	1.921	0.620			
10 mm	Buccal	50	1.473	0.415	-0.703	-4.690	<0.001*
	Lingual	50	2.176	0.892			

Table 2: In maxillary PM right side region buccal cortical bone is significantly more at 10mm with p=0.02. Mean cortical bone thickness at lingual is significantly more at 5mm with p<0.001. In both 5mm and 10mm lingual cortical bone was thicker and 5mm shows significant result with p<0.001

Comparison of mean Cortical Bone thickness in Max. 1st & 2nd Premolar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.347	0.751	-0.089	-2.448	0.02*
	10 mm	50	1.436	0.849			
Lingual	5 mm	50	1.797	0.642	0.226	4.175	<0.001*
	10 mm	50	1.570	0.420			
5 mm	Buccal	50	1.347	0.751	-0.450	-10.571	<0.001*
	Lingual	50	1.797	0.642			
10 mm	Buccal	50	1.436	0.849	-0.134	-1.832	0.07

Table 3: In maxillary PM left side no significant difference was noted at both buccal and lingual side at 5mm and 10mm.At 5mm and 10mm lingual cortical bone was significantly thicker with p<0.001 and p=0.003

Comparison of mean Cortical Bone thickness in Max. 1st & 2nd Premolar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.505	0.633	0.060	0.639	0.53
	10 mm	50	1.444	0.563			
Lingual	5 mm	50	1.770	0.447	0.147	1.967	0.06
	10 mm	50	1.622	0.363			
5 mm	Buccal	50	1.505	0.633	-0.265	-6.281	<0.001*
	Lingual	50	1.770	0.447			
10 mm	Buccal	50	1.444	0.563	-0.178	-3.186	0.003*
	Lingual	50	1.622	0.363			

Table 4: In between maxillary 2nd PM and 1st molar in right side buccal cortical bone is significantly thicker at 10mm with p=0.04.

Comparison of mean Cortical Bone thickness in Max. 2nd PM & 1st Molar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.481	0.678	0.212	2.040	0.04*
	10 mm	50	1.693	0.783			
Lingual	5 mm	50	1.561	0.368	0.151	1.916	0.06

	10 mm	50	1.711	0.527			
5 mm	Buccal	50	1.481	0.783	-0.079	-0.197	0.84
	Lingual	50	1.561	0.527			
10 mm	Buccal	50	1.693	0.678	-0.018	-0.788	0.44
	Lingual	50	1.711	0.368			

Table 5: In between maxillary 2nd PM and 1st molar in left side at 10mm lingual cortical bone was significantly thicker with p=0.001

Comparison of mean Cortical Bone thickness in Max. 2nd PM & 1st Molar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.543	0.468	0.104	1.132	0.26
	10 mm	50	1.647	0.606			
Lingual	5 mm	50	1.745	0.350	-0.072	-1.043	0.30
	10 mm	50	1.673	0.456			
5 mm	Buccal	50	1.543	0.606	-0.202	-0.399	0.69
	Lingual	50	1.745	0.456			
10 mm	Buccal	50	1.647	0.468	-0.026	-4.458	<0.001*
	Lingual	50	1.673	0.350			

Table 6: In mandibular CI region in buccal and lingual cortical bone is relatively thicker at 5mm with no statistical significance. At 5mm and 7mm lingual cortical bone is significantly thicker with p<0.001

Comparison of mean Cortical Bone thickness in Mand. Central Incisor region b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.370	0.502	0.141	1.327	0.19
	7 mm	50	1.229	0.673			
Lingual	5 mm	50	1.794	0.453	0.106	1.512	0.14
	7 mm	50	1.687	0.585			
5 mm	Buccal	50	1.370	0.502	-0.424	-10.898	<0.001*
	Lingual	50	1.794	0.453			
7mm	Buccal	50	1.229	0.673	-0.458	-6.001	<0.001*
	Lingual	50	1.687	0.585			

Table 7: In mandibular PM right side region lingual cortical bone was significantly thicker at 5mm with p=0.001. in both 5mm and 7mm lingual cortical bone is significantly thicker with p=0.001.

Comparison of mean Cortical Bone thickness in Mand. 1st & 2nd Premolar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.631	0.436	0.010	0.184	0.85
	7 mm	50	1.621	0.300			
Lingual	5 mm	50	2.624	0.910	0.354	3.652	0.001*
	7 mm	50	2.269	0.520			
5 mm	Buccal	50	1.631	0.436	-0.993	-6.686	<0.001*
	Lingual	50	2.624	0.910			
7 mm	Buccal	50	1.621	0.300	-0.649	-9.925	<0.001*
	Lingual	50	2.269	0.520			

Table 8 : In mandibular PM left side region lingual cortical bone was significantly thicker at 7mm in both buccal and lingual side with p<0.001 and p=0.04. At 5mm and 7mm lingual cortical bone is significantly thicker with p<0.001.

Comparison of mean Cortical Bone thickness in Mand. 1st & 2nd Premolar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	1.494	0.395	-0.225	-4.096	<0.001*
	7 mm	50	1.719	0.375			
Lingual	5 mm	50	2.310	0.609	-0.170	-2.058	0.04*
	7 mm	50	2.480	0.922			
5 mm	Buccal	50	1.494	0.395	-0.816	-7.279	<0.001*
	Lingual	50	2.310	0.609			
7 mm	Buccal	50	1.719	0.375	-0.761	-6.536	<0.001*

Table 9: In mandibular 2nd PM and 1st molar region in right side buccal cortical bone is significantly thicker at 7mm with p=0.002. At 5mm and 7mm lingual cortical bone is significantly thicker with p<0.001

Comparison of mean Cortical Bone thickness in Mand. 2nd PM & 1st Molar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.015	0.405	-0.119	-3.245	0.002*
	7 mm	50	2.135	0.381			
Lingual	5 mm	50	2.391	0.527	0.030	0.480	0.63
	7mm	50	2.362	0.381			

5 mm	Buccal	50	2.015	0.405	-0.376	-4.499	<0.001*
	Lingual	50	2.391	0.527			
7 mm	Buccal	50	2.135	0.381	-0.227	-3.771	<0.001*
	Lingual	50	2.362	0.381			

Table 10: In mandibular 2nd PM and 1st molar region in left side lingual cortical bone is significantly thicker at 7mm with p<0.001. At 7mm lingual cortical bone is significantly thicker with p<0.001.

Comparison of mean Cortical Bone thickness in Mand. 2nd PM & 1st Molar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.019	0.348	0.045	0.905	0.37
	7mm	50	1.974	0.415			
Lingual	5 mm	50	2.126	0.487	-0.204	-3.953	<0.001*
	7 mm	50	2.330	0.645			
5 mm	Buccal	50	2.019	0.348	-0.107	-1.468	0.15
	Lingual	50	2.126	0.487			
7 mm	Buccal	50	1.974	0.415	-0.356	-5.523	<0.001*

Comparison of mesio distal width

Table 11: In maxillary CI region buccal and lingual MDW is significantly more at 10mm with p <0.001 and p=0.001. At both 5mm and 10mm MDW is significantly more at lingual side with p<0.001.

Comparison of mean Mesio-distal Width in Max. Central Incisor region b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.377	0.994	-1.409	-7.485	<0.001*
	10 mm	50	3.786	0.807			
Lingual	5 mm	50	3.827	1.547	-0.706	-3.642	0.001*
	10 mm	50	4.533	1.053			
5 mm	Buccal	50	2.377	0.994	-1.450	-10.671	<0.001*
	Lingual	50	3.827	1.547			
10 mm	Buccal	50	3.786	0.807	-0.747	-7.018	<0.001*

Table 12: In maxillary 1st and 2nd PM region in right side buccal MDW is significantly more at 10mm with p=0.007. where as in lingual side MDW is relatively more at 10mm.At 5mm lingual MDW is significantly more with p=0.04.

Comparison of mean Mesio-distal Width in Max. 1st & 2nd Premolar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.364	0.963	-0.319	-2.813	0.007*
	10 mm	50	2.684	0.852			
Lingual	5 mm	50	2.548	0.751	-0.089	-0.556	0.58
	10 mm	50	2.637	0.684			
5 mm	Buccal	50	2.364	0.963	-0.183	-2.031	0.04*
	Lingual	50	2.548	0.751			
10 mm	Buccal	50	2.684	0.852	0.047	0.365	0.72

Table 13 : In maxillary 1st and 2nd PM region in left side buccal and lingual MDW is significantly more at 10mm with p=0.01. At 5mm and 10mm MDW is relatively more at lingual side.

Comparison of mean Mesio-distal Width in Max. 1st & 2nd Premolar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.552	0.775	-0.454	-2.659	0.01*
	10 mm	50	3.006	0.763			
Lingual	5 mm	50	2.638	0.839	-0.447	-2.563	0.01*
	10 mm	50	3.085	0.773			
5 mm	Buccal	50	2.552	0.775	-0.087	-0.934	0.36
	Lingual	50	2.638	0.839			
10 mm	Buccal	50	3.006	0.763	-0.079	-0.749	0.46

Table 14 : In maxillary 2nd PM and 1st molar region in right side buccal and lingual MDW is significantly more at 10mm with p<0.001. At 5mm lingual MDW is significantly more with p=0.02 and at 10mm lingual MDW is significantly more with p=0.002.

Comparison of mean Mesio-distal Width in Max. 2nd PM & 1st Molar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.988	0.743	-0.396	-4.335	<0.001*
	10 mm	50	3.384	0.772			
Lingual	5 mm	50	3.339	1.070	-0.614	-4.372	<0.001*
	10 mm	50	3.953	1.148			

5 mm	Buccal	50	2.988	0.743	-0.351	-2.413	0.02*
	Lingual	50	3.339	1.070			
10 mm	Buccal	50	3.384	0.772	-0.569	-3.320	0.002*

Table 15: In maxillary 2nd PM and 1st molar region in left side buccal and ligual MDW is significantly more at 10mm with p<0.001. At 5mm lingual MDW is more with p=0.04 and at 10mm lingual MDW is more with p=0.003.

Comparison of mean Mesio-distal Width in Max. 2nd PM & 1st Molar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	2.864	0.769	-0.517	-3.762	<0.001*
	10 mm	50	3.381	0.873			
Lingual	5 mm	50	3.178	0.796	-0.726	-4.385	<0.001*
	10 mm	50	3.904	0.970			
5 mm	Buccal	50	2.864	0.769	-0.314	-2.129	0.04*
	Lingual	50	3.178	0.796			
10 mm	Buccal	50	3.381	0.873	-0.523	-3.164	0.003*

Table 16: In mandibular 1st and 2nd PM right side region at both buccal and lingual region MDW is significantly more at 7mm with p<0.001. At 5mm and 7mm lingual MDW is significantly more with p=0.002 and p=0.001.

Comparison of mean Mesio-distal Width in Mand. 1st & 2nd Premolar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	3.649	1.026	-0.521	-4.871	<0.001*
	7 mm	50	4.170	0.893			
Lingual	5 mm	50	3.887	1.219	-0.576	-3.733	<0.001*
	7mm	50	4.463	1.155			
5 mm	Buccal	50	3.649	1.026	-0.238	-3.258	0.002*
	Lingual	50	3.887	1.219			
7 mm	Buccal	50	4.170	0.893	-0.293	-3.353	0.001*

Table 17: In mandibular 1st and 2nd PM in left side region at both buccal and lingual side MDW is significantly more at 7mm with p<0.001. At 5mm and 7mm lingual MDW is significantly more with p<0.001.

Comparison of mean Mesio-distal Width in Mand. 1st & 2nd Premolar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	3.576	1.130	-0.337	-4.103	<0.001*
	7 mm	50	3.913	0.885			
Lingual	5 mm	50	4.031	1.023	-0.466	-4.085	<0.001*
	7 mm	50	4.497	0.930			
5 mm	Buccal	50	3.576	1.130	-0.455	-5.840	<0.001*
	Lingual	50	4.031	1.023			
7 mm	Buccal	50	3.913	0.885	-0.584	-9.403	<0.001*

Table 18: In mandibular 2nd PM and 1st molar region in right side buccal and lingual MDW is relatively more at 7mm. At 5mm and 7mm MDW is significantly more in buccal with p<0.001

Comparison of mean Mesio-distal Width in Mand. 2nd PM & 1st Molar region on Right side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	4.092	1.909	-0.207	-1.865	0.07
	7 mm	50	4.299	1.946			
Lingual	5 mm	50	3.458	1.218	-0.152	-0.945	0.35
	7mm	50	3.610	1.429			
5 mm	Buccal	50	4.092	1.909	0.634	3.849	<0.001*
	Lingual	50	3.458	1.218			
7 mm	Buccal	50	4.299	1.946	0.689	6.579	<0.001*
	Lingual	50	3.610	1.429			

Table 19: In mandibular 2nd PM and 1st molar region in left side buccal and lingual MDW is significantly more with p<0.001 and p=0.04. At 7mm MDW is significantly more in buccal with p=0.008.

Comparison of mean Mesio-distal Width in Mand. 2nd PM & 1st Molar region on Left side b/w Buccal & Lingual cortical plates and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Buccal	5 mm	50	3.756	1.605	-0.428	-4.890	<0.001*
	7 mm	50	4.185	2.093			
Lingual	5 mm	50	3.462	0.764	-0.235	-2.068	0.04*
	7 mm	50	3.697	1.165			

5 mm	Buccal	50	3.756	1.605	0.294	1.865	0.07
	Lingual	50	3.462	0.764			
7 mm	Buccal	50	4.185	2.093	0.488	2.765	0.008*

Comparison of Mean Bucco Lingual Thickness **(BLT)**

Table 20: In maxillary CI region a significant increase in BLT is observed at 10mm with p<0.001.

Comparison of mean Bucco-Lingual Thickness in Max. Central Incisor region b/w 5mm & 10mm height using Student Paired t Test							
Tooth	Category	N	Mean	SD	Mean Diff	t	P-Value
CI	5 mm	50	7.921	0.807	-2.493	-5.453	<0.001*
	10 mm	50	10.413	3.098			

Table 21: In maxillary PM region a significant increase in BLT is observed at 10 mm with p=0.004.

Comparison of mean Bucco-Lingual Thickness in Max. 1st & 2nd Premolar region based on Right & Left sides and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Right	5 mm	50	9.808	0.725	-0.079	-0.946	0.35
	10 mm	50	9.887	1.000			
Left	5 mm	50	9.617	0.785	-0.472	-3.056	0.004*
	10 mm	50	10.089	1.085			
5 mm	Right	50	9.808	0.725	0.191	2.828	0.007*
	Left	50	9.617	0.785			
10 mm	Right	50	9.887	1.000	-0.202	-2.236	0.03*
	Left	50	10.089	1.085			

Table 22: In maxillary 2nd PM and 1st molar region a significant increase in BLT is observed at 10mm with p<0.001

Comparison of mean Bucco-Lingual Thickness in Max. 2nd PM & 1st Molar region based on Right & Left sides and also b/w 5mm & 10mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Right	5 mm	50	10.303	1.133	-1.681	-10.897	<0.001*
	10 mm	50	11.984	1.539			
Left	5 mm	50	10.316	1.345	-2.194	-8.973	<0.001*
	10 mm	50	12.510	1.504			
5 mm	Right	50	10.303	1.133	-0.012	-0.168	0.87
	Left	50	10.316	1.345			
10 mm	Right	50	11.984	1.539	-0.526	-4.104	<0.001*
	Left	50	12.510	1.504			

Table 23: In mandibular CI region a significant increase in BLT is observed at 5mm with p=0.04

Comparison of mean Bucco-Lingual Thickness in Mand. Central Incisor region b/w 5mm & 10mm height using Student Paired t Test							
Tooth	Category	N	Mean	SD	Mean Diff	t	P-Value
CI	5 mm	50	7.563	1.681	0.135	2.086	0.04*
	7 mm	50	7.428	1.643			

Table 24: In mandibular PM region a relative increase in BLT is observed at 5mm

Comparison of mean Bucco-Lingual Thickness in Mand. 1st & 2nd Premolar region based on Right & Left sides and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Right	5 mm	50	9.301	1.790	0.220	1.642	0.11
	7 mm	50	9.081	2.071			
Left	5 mm	50	9.141	1.900	0.073	0.574	0.57
	7 mm	50	9.068	2.213			
5 mm	Right	50	9.301	1.790	0.160	2.648	0.01*
	Left	50	9.141	1.900			
7 mm	Right	50	9.081	2.071	0.012	0.182	0.86

Table 25: In mandibular 2nd PM and 1st molar region a significant increase in BLT is observed at 7mm.

Comparison of mean Bucco-Lingual Thickness in Mand. 2nd PM & 1st Molar region based on Right & Left sides and also b/w 5mm & 7mm height using Student Paired t Test							
Variables	Category	N	Mean	SD	Mean Diff	t	P-Value
Right	5 mm	50	10.857	1.442	-0.401	-3.939	<0.001*
	7 mm	50	11.257	1.909			
Left	5 mm	50	11.105	1.867	0.177	0.993	0.33
	7 mm	50	10.928	1.920			
5 mm	Right	50	10.857	1.442	-0.248	-2.724	0.009*
	Left	50	11.105	1.867			
7 mm	Right	50	11.257	1.909	0.329	3.852	<0.001*

A significant difference was observed in all depth at both buccal and lingual side

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