International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 8; Issue 09 (D); September 2019; Page No.20004-20008
DOI: http://dx.doi.org/10.24327/ijcar.2019.3894.20008

Research Article

IDENTIFICATION OF IDEAL SITE OF PLACING MINI-IMPLANT IN PARA-MEDIAN PALATE: A CONE BEAM COMPUTERIZED TOMOGRAPHY STUDY

Raj Parthdev, Akshai Shetty K R, Amarnath B C, Dharma R M and Prashanth C S

DAPM R.V Dental College & Hospital, Bangalore

A R T I C L E I N F O

Article History:
Received 4th June, 2019
Received in revised form 25th July, 2019
Accepted 18th August, 2019
Published online 28th September, 2019

Key words:

Ideal site, Mini-implant, Paramedian Palate, Computed Tomography

A B S T R A C T

Introduction: Mini-implants have become an important part of Orthodontics for the purpose of absolute anchorage.
Aim: To identify the ideal site of placement of mini-implant in para-median palate.
Materials and Methods: Cone beam computed tomographic scans of Twenty-Five patients (Age 10-19years) were collected for pre-orthodontic records. From the distal of the incisive foramen, three planes 4, 8, and 12mm and the distances 3, 6, and 9mm from the midline were selected. The bone depth and density were measured at each of the intersection of planes and distances using Galileos software.
Results: There was statistically significant difference in the bone depth and density at sites four mm distal to incisive foramen and nine mm lateral to the midline ($P_{4\text{-}9}$) and eight mm distal to incisive foramen and nine mm lateral to the midline ($P_{8\text{-}9}$).
Conclusion: The ideal site for placement of palatal implants in adults (above 16years) is four mm distal to incisive foramen and nine mm lateral to the midline ($P_{4\text{-}9}$) and eight mm distal to incisive foramen and nine mm lateral to the midline ($P_{8\text{-}9}$) and for young adults (11-16years) is four mm distal to incisive foramen and nine mm lateral to the midline ($P_{4\text{-}9}$).

INTRODUCTION

Mini-implants have much better advantages and can be used as alternative to extraoral anchorage. In order to achieve an absolute anchorage, mini-implants provide an easy, convenient and relatively low-cost method with minimal patient compliance.[1]

The reason for preferring palate as an implant site is because it is easily approachable, relatively safe, increased blood flow leading to less inflammation with good bone density. The midpalatal area or the paramedian site is commonly used as a site for absolute anchorage.[2,3] In cases where the midpalatal region cannot be used as implant site, the paramedian area is prefferd.[1] The various biomechanics that can be carried out by mini implant in the anterior palate includes Molar mesialization, Molar distalization, Rapid maxillary expansion, Intrusion and Disimpaction.[4,5,6]

As there are high chances of fracture during insertion of miniscrew, the selection of the dimension is very important.[7] The insertion site is an important factor in selecting the dimension of the screw. When the screw is placed at the desired site through the attached gingiva, a minimum of half of the screw should be in the cortical bone with access to its head.[8]

Corresponding author:* **Raj Parthdev
DAPM R.V Dental College & Hospital, Bangalore

The mini-implant should not hinder with any type of tooth movement and should also allow any biomechanical changes if required during the orthodontic treatment.[9] All these requirements are fulfilled by the anterior palate with minimal risk of iatrogenic injury as the blood-vessel density is relatively low.[3,10,11] There are reports that the range of success of mini-implants has been between 70% and 89% in general and 100% for miniscrews inserted in the anterior palate.[12,13,14] Thus, it is important to have knowledge of osseous conditions of the site of mini-implant placement.[2,3,15,16] Therefore, the aim of this study was to quantitatively evaluate bone depth and density in the palate so as to find out an ideal site for mini-implant placement.

MATERIALS AND METHODS

A total of 25 patients (13 female and 12 male) who were in the age group of 10-19 years volunteered to participate, were selected with their informed consent.

Inclusion Criteria

- Patients with good health between the age range of 10-19 years who came for treatment of malocclusion.
- Written informed consents were obtained from all patients or the parents of those under 18 years of age.

Exclusion criteria

- Patients with supernumerary teeth, cleft palate, or previous orthodontic treatment were excluded from the study.

METHODOLOGY

The methodology was divided into three main steps;

1. CBCT scan for the maxillary arch
2. Identification of the reference points
3. Measuring the bone depth and bone density

Step 1: CBCT scan for the maxillary arch

CBCT Machine: Sirona - Orthopos XG 3D model was used to take maxillary CBCT with FOV of 8*8 cm; images were reconstructed into Axial, Coronal & Sagittal planes with Galileos software.

Step 2: Identification of the reference points

In the Axial view of the Galileos software, midline of the Maxilla was positioned and starting from the distal of the incisive foramen, three planes 4mm, 8mm, and 12 mm and the distances 3mm, 6mm, and 9 mm from the midline were marked on the left side only. The intersections of distances and planes resulted in 9 locations, described as the measuring locations (Figure 1).

Measuring Location	Relationship to the incisive foramen (mm distal, mm lateral)
$P_{4\text{-}3}$	4,3
$P_{4\text{-}6}$	4,6
$P_{4\text{-}9}$	4,9
$P_{8\text{-}3}$	8,3
$P_{8\text{-}6}$	8,6
$P_{8\text{-}9}$	8,9
$P_{12\text{-}3}$	12,3
$P_{12\text{-}6}$	12,6
$P_{12\text{-}9}$	12,9

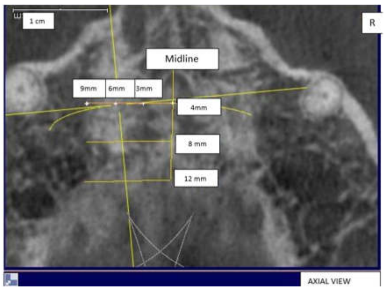

Figure 1 Measuring locations in relation to incisive foramen (distal and lateral) in Axial view.

Step 3: Measuring the bone depth and bone density

In the Tangential view of the Galileos software, the palate was positioned from the anterior. The view was further navigated towards the left by 3mm till the slice with the points $P_{4\text{-}3}$, $P_{8\text{-}3}$, $P_{12\text{-}3}$ were seen. The measurement tool was used to measure the palatal depth of the bone followed by the bone density measurement tool to measure the density of the bone at $P_{4\text{-}3}$, $P_{8\text{-}3}$, $P_{12\text{-}3}$ in mean grey value. The same procedure was followed to measure the bone depth and density for the points $P_{4\text{-}6}$, $P_{8\text{-}6}$, $P_{12\text{-}6}$, $P_{4\text{-}9}$, $P_{8\text{-}9}$ & $P_{12\text{-}9}$ (Figure 2 & 3).

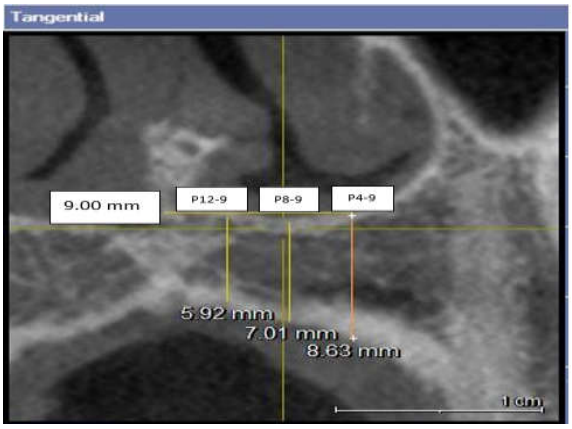

Figure 2 Measuring the bone depth at reference points in Tangential view.

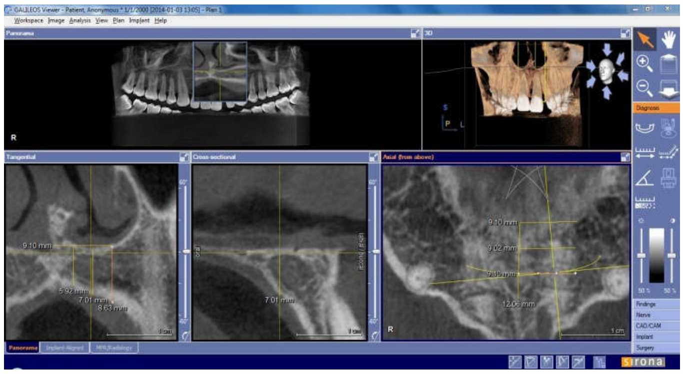

Figure 3 Measuring the bone depth and density using Galileos software.

The mini-implants preferred in the palate are of 3.3mm and 3.75mm of diameter and 3mm and 4mm of lengths. A one-mm buffer is needed for surgical placement of mini-screw implant beyond these measurements.[17] For this study, 4 mm length and 6 mm diameter (1-mm buffer on length and 1 mm on either side of the diameter gives 5.75 mm, rounded to 6 mm for ease of measurement) was the minimum bone volume required for implantation.

Statistical analysis was done to describe the minimum vertical bone volume available in the region of interest at each measuring location using Student t-test, Fisher's exact test & Kruskal-Wallis test.

RESULTS

A total of nine sites were obtained for each patient with three planes and three distances per plane for 25 patients. Thus, a total of 225 measurements were obtained of which 13 measurements were removed from the analysis because of contact with the unerupted teeth resulting in 212 measurements for further analysis.

The association of gender showed no statistically significant values with the mean vertical bone depth but it showed statistically significant values at three regions for the mean bone density. The regions $P_{8\text{-}9}$, $P_{12\text{-}3}$ & $P_{12\text{-}6}$ showed statistically significant p-values (0.01, 0.02 & 0.03), indicating that the bone density is significantly higher in females (Table 1 & 2).

The association of age (10-13years, 14-16years & 17-19years) with the mean vertical bone depth showed no statistically significant difference, while the mean bone density showed statistically significant values at two regions. The increase in the mean bone density from age group 10-13years to 14-16years & from 10-13years to 17-19years was statistically significant (p-value 0.04 & 0.008) for the region $P_{8\text{-}3}$ and (p-value 0.007 & 0.008) for the region $P_{12\text{-}9}$ (Table 3 & 4).

The comparison of vertical mean bone depth revealed that at the plane four mm, the site $P_{4\text{-}9}$ has statistically significant bone depth (p-value 0.01), followed by the site $P_{8\text{-}9}$ (p-value 0.05) at the plane eight mm distal to the incisive foramen. The comparison of mean bone density revealed that the sites $P_{4\text{-}9}$, $P_{8\text{-}9}$ & $P_{12\text{-}9}$ has the highest bone densities, but the value did not show statistical significance (Table 5,6 & 7).

Table 1 Mean Minimum bone depth measurements (in mm) in each ROI using Student unpaired t test.

ROI	Males				Females				Difference	P-Value
	Mean	SD	95% CI		Mean	SD	95% CI			
			Lower	Upper			Lower	Upper		
P_{4-3}	10.86	3.94	7.74	14.08	7.96	4.42	4.32	10.62	2.90	0.10
P_{4-6}	11.77	4.51	9.78	15.02	8.69	3.43	6.26	11.67	3.08	0.09
P_{4-9}	14.52	5.31	13.24	18.28	12.92	5.39	8.82	17.51	1.60	0.50
P_{8-3}	5.95	2.23	3.68	6.56	6.36	3.25	3.56	8.06	-0.41	0.72
P_{8-6}	6.80	3.06	3.69	7.16	6.92	3.46	3.98	8.58	-0.12	0.93
P_{8-9}	8.40	3.29	5.49	9.64	7.95	2.69	6.01	10.27	0.45	0.73
P_{12-3}	3.98	2.08	1.98	5.41	4.23	3.51	2.3	4.36	-0.25	0.83
P_{12-6}	3.85	2.43	1.41	5.28	4.55	5.00	1.79	4.4	-0.70	0.65
P_{12-9}	5.25	3.03	2.49	5.47	6.01	4.25	3.22	6.73	-0.77	0.60

Table 2 Mean Minimum bone density measurements in each ROI using Student unpaired t -test.

ROI	Males				Females				Difference	P-Value
	Mean	SD	95% CI		Mean	SD	95% CI			
			Lower	Upper			Lower	Upper		
P_{4-3}	1558.46	93.08	1500.2	1636.2	1596.64	91.29	1518.8	1666.1	-38.18	0.32
P_{4-6}	1611.17	110.02	1527.4	1696.3	1572.90	151.76	1452.2	1699.2	38.27	0.50
P_{4-9}	1617.27	128.20	1534.4	1720.7	1653.70	152.84	1534.4	1720.7	-36.43	0.56
P_{8-3}	1566.93	205.32	1457.5	1773.2	1614.60	153.63	1457.5	1773.2	-47.67	0.54
P_{8-6}	1549.21	147.24	1459.8	1678.7	1594.30	179.83	1459.8	1678.7	-45.09	0.51
P_{8-9}	1530.00	108.63	1463.7	1626.2	1656.10	98.06	1590.8	1741.8	-126.10	0.01*
P_{12-3}	1454.43	195.47	1337.7	1591.4	1640.91	154.17	1578.9	1787.9	-186.48	0.02*
P_{12-6}	1486.36	167.39	1399.3	1609.8	1616.36	116.85	1539.5	1725.3	-130.01	0.04*
P_{12-9}	1478.07	139.23	1445.9	1608.1	1538.09	150.81	1428.8	1677.3	-60.02	0.31

Note: *Statistically significant

Table 3 Age wise Comparison of Mean Minimum bone depth measurements (in mm) in each ROI using Kruskal Wallis test.

ROI	10-13 years Age				14-16 years Age				17-19 years Age				P-Value
	Mean	SD	95% CI		Mean	SD	95% CI		Mean	SD	95% CI		
			Lower	Upper			Lower	Upper			Lower	Upper	
P_{4-3}	9.03	4.60	3.32	14.74	9.13	3.97	5.81	12.44	10.05	4.81	6.82	13.28	0.96
P_{4-6}	9.98	3.65	4.18	15.78	8.44	4.65	4.14	12.74	11.74	4.06	9.02	14.47	0.27
P_{4-9}	14.87	4.22	4.39	25.34	11.49	7.06	4.96	18.03	14.90	4.10	12.15	17.65	0.48
P_{8-3}	7.93	2.76	4.50	11.37	5.51	1.47	4.28	6.74	5.74	3.07	3.67	7.80	0.25
P_{8-6}	9.28	3.03	5.52	13.04	6.59	2.41	4.58	8.61	5.94	3.36	3.68	8.20	0.15
P_{8-9}	8.68	2.17	5.22	12.14	8.15	3.04	5.33	10.96	8.05	3.38	5.78	10.32	0.91
P_{12-3}	5.44	4.43	0.79	10.09	3.57	1.40	2.40	4.74	3.74	2.31	2.19	5.29	0.62
P_{12-6}	5.90	6.63	-1.05	12.86	3.69	1.79	2.19	5.18	3.56	2.52	1.86	5.25	0.76
P_{12-9}	7.65	5.87	1.48	13.81	5.34	2.67	3.11	7.57	4.64	2.13	3.21	6.08	0.65

Table 4 Age wise Comparison of Mean Minimum bone height measurements (in mm) in each ROI using Kruskal Wallis test fld by Mann Whitney Post hoc Analysis.

ROI	10-13years Age				14-16years Age				17-19years Age				P-Value	Sig. Diff	P-value
	Mean	SD	95% CI		Mean	SD	95% CI		Mean	SD	95% CI				
			Lower	Upper			Lower	Upper			Lower	Upper			
P_{4-3}	1509.60	111.44	1371.23	1647.97	1590.25	74.29	1528.14	1652.36	1595.73	89.30	1535.74	1655.72	0.24		
P_{4-6}	1542.00	53.73	1456.50	1627.50	1601.14	106.26	1502.87	1699.42	1607.91	160.84	1499.85	1715.96	0.21		
P_{4-9}	1712.67	244.698	1104.8	2320.53	1603.71	109.19	1502.73	1704.70	1633.00	128.55	1546.64	1719.36	0.69		
P_{8-3}	1411.60	85.45	1305.50	1517.70	1596.13	193.63	1434.25	1758.00	1659.64	164.18	1549.34	1769.94	0.02*	1vs2, 1vs3	0.04*, 0.008*
P_{8-6}	1479.2	86.106	1372.29	1586.11	1562.25	161.839	1426.95	1697.55	1612.55	176.126	1494.22	1730.87	0.33		
P_{8-9}	1531.75	70.092	1420.22	1643.28	1550	106.964	1451.07	1648.93	1631.27	132.79	1542.06	1720.48	0.13		
P_{12-3}	1476.67	226.90	1238.55	1714.79	1498.38	185.95	1342.92	1653.83	1596.82	193.91	1466.54	1727.09	0.41		
P_{12-6}	1517.67	137.91	1372.93	1662.40	1477.88	149.63	1352.78	1602.97	1605.45	165.05	1494.58	1716.33	0.23		
P_{12-9}	1415.50	128.67	1280.47	1550.53	1433.25	134.21	1321.05	1545.45	1604.82	96.92	1539.71	1669.93	0.005*	1vs3, 2vs3	0.007*, 0.008*

Note: *Statistically significant

Table 5 Comparison of Mean Depth & Density for Minimum bone heights (in mm) at 4 mm using ANOVA fld by Bonferroni post hoc Analysis.

Parameter	ROI	Mean	SD	95% Cl Lower	95% Cl Upper	P-value	Sig. Diff	P-Value
Depth	P_{4-3}	9.53	4.33	7.70	11.36	0.009*	43 Vs 49	0.01*
	P_{4-6}	10.37	4.26	8.48	12.26			
	P_{4-9}	13.76	5.28	11.36	16.16			
Density	P_{4-3}	1575.96	92.31	1536.98	1614.94	0.25	--	--
	P_{4-6}	1593.77	128.81	1536.66	1650.88			
	P_{4-9}	1634.62	138.12	1571.75	1697.49			

Note: *Statistically significant

Table 6 Comparison of Mean Depth & Density for Minimum bone heights (in mm) at 8 mm using ANOVA fld by Bonferroni post hoc Analysis.

Parameter	ROI	Mean	SD	95% Cl Lower	95% Cl Upper	P-value	Sig. Diff	P-Value
Depth	P_{8-3}	6.12	2.65	5.00	7.24	0.05*	83 Vs 89	0.05*
	P_{8-6}	6.85	3.16	5.52	8.19			
	P_{8-9}	8.19	2.97	6.88	9.51			
Density	P_{8-3}	1586.79	183.41	1509.34	1664.24	0.89	--	--
	P_{8-6}	1568.00	159.44	1500.67	1635.33			
	P_{8-9}	1587.32	120.13	1534.05	1640.58			

Note: *Statistically significant

Table 7 Comparison of Mean Depth & Density for Minimum bone heights (in mm) at 12 mm using ANOVA fld by Bonferroni post hoc Analysis.

Parameter	ROI	Mean	SD	95% Cl Lower	95% Cl Upper	P-value	Sig. Diff	P-Value
Depth	P_{12-3}	4.09	2.73	2.96	5.22	0.21	--	--
	P_{12-6}	4.16	3.71	2.63	5.69			
	P_{12-9}	5.59	3.56	4.12	7.05			
Density	P_{12-3}	1536.48	198.81	1454.42	1618.54	0.38	--	--
	P_{12-6}	1543.56	158.76	1478.03	1609.09			
	P_{12-9}	1504.48	144.57	1444.80	1564.16			

DISCUSSION

Graber defined anchorage as the nature and degree of resistance to displacement offered by an anatomic unit when used for the purpose of affecting tooth movement. But as indicated by Newton's third law - "For every action there is an equal and opposite reaction." Hence, anchorage control is the most important factor for a successful orthodontic treatment.

In conventional orthodontic treatment, the anchorage is obtained from the molar region as it has the maximum surface area in the bone; however, some amount of movement is inevitable. In cases requiring absolute anchorage, devices such as Headgear, Trans-palatal arch, Nance palatal button & Chromosomal arch are used. These appliances need good patient cooperation and are very technique sensitive in patients with missing molars or those requiring distal movement of molars.[18]

Orthodontics has seen a paradigm shift with the introduction of mini-implants & miniplates. Mini-implants provide absolute anchorage leading to a very predictable and efficient tooth-movement.[19,20] The success of mini-implants depends on the quality of the surrounding bone. The success rate is less for maxilla as it more porous than the mandible. However, the palatal area has dense cortical bone, require minimal patient compliance and doesn't interfere with tooth movement which makes it a favourable site.[1,5]

The ossification of midpalatal suture and transverse palatal growth cease, is extremely variable. Melsen (1975) found obliterations of the suture already in 16year old females and 18year old males, but Stockmann *et al.* (2009) found ossifications in only half of the cases investigated in 15 to 20 year olds. In the study by Knaup *et al.* (2004), earliest ossification of the midpalatal suture was found in a 21 year-old male, whereas the oldest unossified midpalatal suture was in a 54 year-old male. Schlegel *et al.* (2002) observed complete ossification in only 40 per cent of patients aged between 23 and 30. Thus the paramedian palate is a preferred site for placement of implants.[21]

In the present study, Cone beam computed tomographic scans of the maxillary arch were obtained for 25 aged 10-19 years. The images were reconstructed into Axial, Coronal & Sagittal planes with Galileos software. The reference points were then identified, followed by measurement of the bone depth and density at nine different points for each patient.

The association of gender with the mean vertical bone depth at each of nine locations showed no statistically significant values, while the mean bone density was higher in females (p-values 0.01, 0.02 & 0.03) showing statistically significance at sites P_{8-9}, P_{12-3}& P_{12-6}. This was in accordance with the study done by Hee Moon et al. (2010) in Korean population while the study by Ghahroudi et al. (2014) in Iranian population & King et al. (2006) in Canadian population, showed higher bone densities in males.[1,3,15]

The association of age (10-13 years, 14-16 years & 17-19 years) with the mean vertical bone depth at each of nine locations showed no statistically significant values, while the mean bone density was statistically significant (p-value 0.04 & 0.008) at the region P_{8-3} and (p-value 0.007 & 0.008) for region P_{12-9}. This was in accordance with the study done by King et al. (2006) in Canadian population and Howell et al. (1981) who reported an increase in palatal index from mixed to permanent dentition while Ghahroudi et al. (2014) in Iranian population, showed no significant difference.[1,3,15]

The comparison of vertical mean bone depth revealed that at the plane four mm, the site P_{4-9} has statistically significant bone depth (p-value 0.01), followed by the site P_{8-9} (p-value 0.05) at the plane eight mm distal to the incisive foramen. King et al. (2006) in Canadian population, demonstrated ideal vertical bone depth at four mm posterior and three mm lateral to incisive foramen. Hee Moon et al. (2010) in Korean population, demonstrated ideal vertical bone depth at three mm posterior and one to five mm lateral to the incisive foramen.[1,3,15] Lai et al. (2010) in Chinese population, demonstrated that the ideal vertical bone depth is three mm posterior, six mm lateral and six mm posterior, nine mm lateral to the incisive foramen.[11] These differences in ideal vertical bone depth may be because of the different races.

CONCLUSION

The conclusions drawn from the study were:

- The ideal site for placement of palatal implants in adults (above 16years) is, four mm distal to incisive foramen and nine mm lateral to the midline P_{4-9} (p-value 0.01) and eight mm distal to incisive foramen and nine mm lateral to the midline P_{8-9} (p-value 0.05) and in young adults (11-16years) is four mm distal to incisive foramen and nine mm lateral to the midline (P_{4-9}).
- Females have higher bone density than males (p-values 0.01, 0.02 & 0.03) showing statistically significance at sites P_{8-9}, P_{12-3}& P_{12-6} and similar bone depths in the paramedian palate.

- Bone depth and density increases with age at all the measuring locations.

Acknowledgement

The authors would like to thank all the faculty members of Department of Orthodontics and Dentofacial Orthopedics for their constant support throughout the research.

References

1. King KS, Lam EW, Faulkner MG, Heo G, Major PW. Vertical bone volume in paramedian palate of adolescents: A computed tomography study. *Am J Orthod Dentofacial Orthop*. 2007;132:783-8.
2. Beat R. Merz, Henrich Wehrbein, Peter Diedrich. Palatal bone support for orthodontic implant anchorage: A clinical and radiological study. *Eur J Orthod.* 1999;21:65-70.
3. Sung Hee Moon, Sun Hyung Park, Won Hee Limc, Youn Sic Chun. Palatal Bone Density in Adult Subjects: Implications for Mini-Implant Placement. *Angle Orthod.* 2010;80:137–144.
4. Telma Martins de Araújo, Mauro Henrique Andrade Nascimento, Fernanda Catharino Menezes Franco, Marcos Alan Vieira Bittencourt. Tooth intrusion using mini-implants. *Dental Press J. Orthod*. 2008;13:36-48.
5. Ayc¸ Arman- zc¸ırpıcı, Alev Yılmaz and Polat-O zsoy. Maxillary Expansion Via Palatal Mini-Implants: A Preliminary Study. *Turkish J Orthod.* 2014;27:16–27.
6. Elena Krieger, Zeynep Yildizhan and Heinrich Wehrbein. One palatal implant for skeletal anchorage frequency and range of indications. *Head & Face Medicine.* 2015;11:15.
7. Marc Schatzle Roland Mannchen Marcel Zwahlen Niklaus P. Lang. Survival and failure rates of orthodontic temporary anchorage devices: a systematic review. *Clin. Oral Impl. Res*. 2009;20:1351–1359.
8. Manuel Nienkemper, Benedict Wilmes, Alexander Pauls and Dieter Drescher. Impact of mini-implant length on stability at the initial healing period: a controlled clinical study. *Head & Face Medicine*. 2013;9:30.
9. Hoi-Jeong Lim, Chun-Sun Eun, Jin-Hyoung Cho, Ki-Heon Lee, Hyeon-Shik Hwang. Factors associated with initial stability of miniscrews for orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 2009;136(2):236-242.
10. Hourfar J, Ludwig B, Bister D, Braun A, Kanavakis G. The most distal palatal ruga for placement of orthodontic mini-implants. *Eur J Orthod*. 2014;21.
11. Sung-Jin Kim and Sung-Hoon Lim. Anatomic study of the incisive canal in relation to midpalatal placement of mini-implant. *Korean J Orthod*. 2009;39(3):146-158.
12. Wehrbein H, Glatzmaier J, Mundwiller U, Diedrich P. The Orthosystem-a new implant system for orthodontic anchorage in the palate. *J Orofac Orthop*. 1996;57:142-53.
13. Britta A. Jung, Martin Kunkel, Peter Go llner, Thomas Liechti, Heinrich Wehrbein. Success Rate of Second-Generation Palatal Implants. *Angle Orthod*. 2009;79:85–90
14. Tolga Topcuoglu, Ali Altug Bicakci, Oral Sokucu, N. Eren Isman. Can Initial Torque Value Predict the Success of Orthodontic Mini-Screws? *Turkish J Orthod.* 2013;26:143–148.
15. Seyedeh Mahsa, Khademi Ghahroudi, Roshanak Ghaffari and Maziyar Mokhtare. Evaluation of bone thickness of hard palate for orthodontic mini implant placement by cone beam computed tomography. *Indian J.Sci.Res*. 2014;5(1):375-381.
16. Ren-fa Lai, Hui Zou, Wei-dong Kong, Wei Ln. Applied Anatomic Site Study of Palatal Anchorage Implants Using Cone Beam Computed Tomography. *Int J Oral Sci*. 2010; 2(2):98–104.
17. De Rezende Barbos, Gabriella Lopes, Ramírez-Sotelo, Laura Ricardin, Távora, Débora de Melo, Solange Maria. Vertical Measurements for Planning Palatal Mini-Implants in Lateral Radiography and Cone Beam Computed Tomography. *Implant Dentistry.* 2014;23(5):588-592.
18. Ahmet Keles, Nejat Erverdi, Serdar Sezen. Bodily Distalization of Molars with Absolute Anchorage. *Angle Orthod*. 2003;73:471–482.
19. Elif Gündüz, Thorsten T. Schneider-Del Savio, Gerhard Kucher, Barbara Schneider and Hans Peter Bantleon. Acceptance rate of palatal implants: A questionnaire study. *Am J Orthod Dentofacial Orthop*. 2004;126:623-6.
20. Gahleitner A, Podesser B, Schick S, Watzek G, Imhof H. Dental CT and orthodontic implants: imaging technique and assessment of available bone volume in the hard palate. *Eur J Radiol.* 2004;51:257-62.
21. Friedman M, Schalch P, Lin HC, Kakodkar KA, Joseph NJ, Mazloom N. Palatal implants for the treatment of snoring and obstructive sleep apnea/hypopnea syndrome. *Otolaryngol Head Neck Surg.* 2008; 138(2):209-16.

How to cite this article:

Raj Parthdev *et al* (2019) 'Identification of Ideal Site of Placing Mini-Implant in Para-Median Palate: A Cone Beam Computerized Tomography Study', *International Journal of Current Advanced Research,* 08(09), pp. 20004-20008.
DOI: http://dx.doi.org/10.24327/ijcar.2019.3894.20008

****