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Use of CBCT As Diagnostic Aid in the Treatment Planning for Implants in Mandibular Premolars Among South Indian Population

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Abstract:

Aim: Determination of mental foramen location in relation to the crest of the edentulous space in mandibular first/second premolars and the inferior border of body of the mandible in treatment planning for placement of implants

Materials and Methods: To study 21 CBCT's of patients who are partially edentulous in remandibular premolars, SPSS software version 22 for statistical analysis. The CBCT's were inserted into a laptop computer (Macbook air) and the mental foramen was measured from the crest of the edentulous ridge and the base of the mandible.

Results: A total of n= 21 patients were assessed by CBCT, with 13 females and 8 males. Of the 21 patients assessed by CBCT analysis the average distance from mandibular 1st premolar was 15.9mm from the crest of the edentulous ridge and 10.44mm from the base. Similarly average distance from crest of edentulous space and base of mandible for mandibular second premolar was 15.46mm and 13.65mm.

Keywords: *CBCT, Crest of alveolar ridge, Mental foramen, Mental nerve*

INTRODUCTION:

For the successful placement of implants in the region of mandibular first and second premolars knowledge of proper location of mental foramen plays a key role[1].The mental foramen present in the human mandible serves as anatomical landmark for the passage of mental nerves and vessels. There are many anatomical variations in this foramen when it comes to it shape, size, location and direction of opening[2,3,4]. The inferior alveolar nerve bundle enters the mandible through the mandibular foramen, passes along the mandibular canal and exits from the mental foramen as the mental nerve on the body of the mandible above the tubercle of the chin [5, 6]. From here the it enters the fascia covering the mandible where it then provides innervation to the skin of the lower lip, chin, gingival and labial mucous membranes [7]. Neural trauma commonly occurs in the mandible and can be attributed to the damage of the inferior alveolar nerve or the mental nerve [8]. Without proper understanding of the location of the neurovascular bundle, surgical procedures may lead to bruising, transportation or complete dissection which may lead to either dysphasia, parasthesia or anesthesia [1].

The mental nerve is a general somatic afferent nerve that is the terminal branch of the posterior trunk of the inferior alveolar nerve which is a branch of trigeminal nerve. This nerve is accompanied by the mental artery which is a branch of inferior alveolar artery. A lot of effort has been put in for the location of mental foramen. Many authors have put effort into determining the size, shape, location and orientation of the mental foramen with the use of either dissected mandibles or radiographs. The diameter of the foramen has been found to range from 2.47-7.3mm [9, 10, 11, 12]. The mental foramen does not have distinct surface anatomical landmarks and hence cannot visualized or palpated. Due to this difficulty in locating the mental foramen, the data taken from previous studies is used to plan ahead various surgical procedures.

The data may have been obtained either through dissection of human mandibles or with the help of radiographs. While radiographs may be useful in giving us an idea of the location of mental foramen, they fail to give the practitioner a three-dimensional image of the orientation of the neurovascular bundle, nor do radiographs help us differentiate the mental foramen from an apical radiolucency related to pulpal pathosis of the mandibular premolars [1].

An image that is three-dimensional would be ideal for planning surgeries in the area of mental foramen as it has high spatial resolution exposures. Such attributes can be attained from Cone Beam Computed Tomography (CBCT), which in addition to making it an ideal form of imaging, also allows a clear understanding of the relationship between structures in an anatomically complex area [13, 14].

MATERIALS AND METHODS

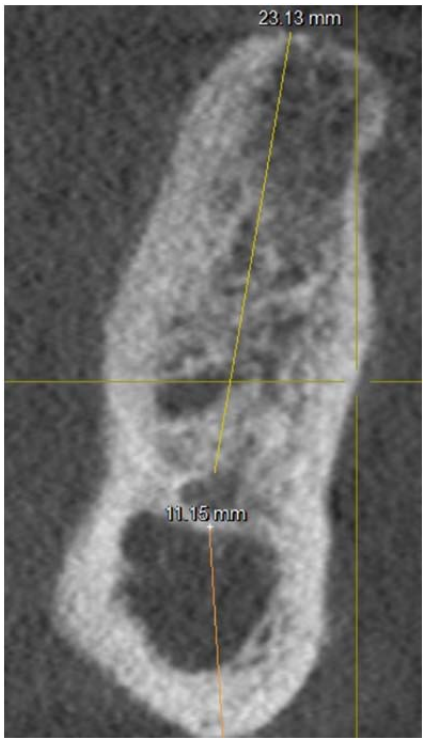
Volumetric data from CBCT examination of 21 partially edentulous patients with missing 1st or 2nd premolars in the mandibular region to produce 2-dimensional images in serial planes as well as three-dimensional images of the entire mandible. A laptop cpmputer (MacBook Air). Once images were constructed, two measurements were taken to represent the distance in millimeters from the upper border of the mental foramen to the crest of the edentulous space and the lower border of foramen to the base of the mandible. CBCT scans of patients were selected from those attending the Implantology Department of Saveetha Dental College& Hospitals. Statistical analysis was done using SPSS software version 22.

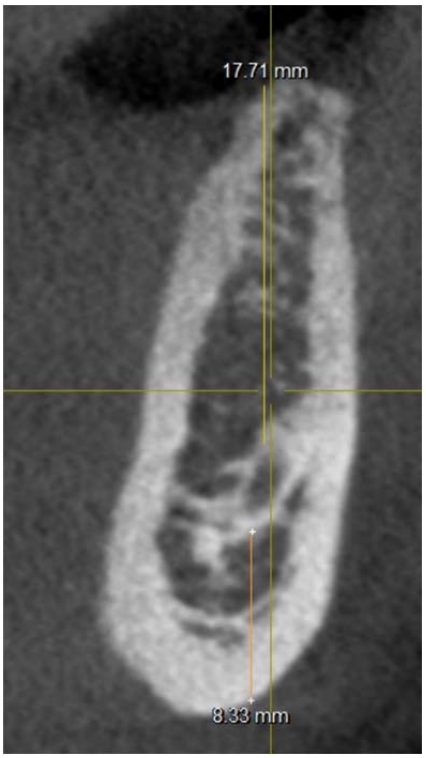
Inclusion Criteria:

1. Patients older than 20 years of age.
2. Patients with missing mandibular 1st and/or 2nd premolars.
3. Period of edentulous crest in mandibular premolar region is of 6 years or less.

Exclusion Criteria:

1. Patients with intact mandibular premolars.
2. Patients with diabetes.
3. Patients with over 10 years of edentulism

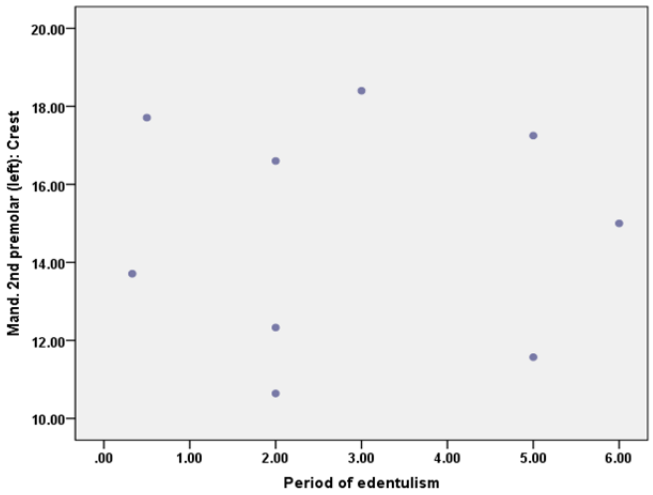


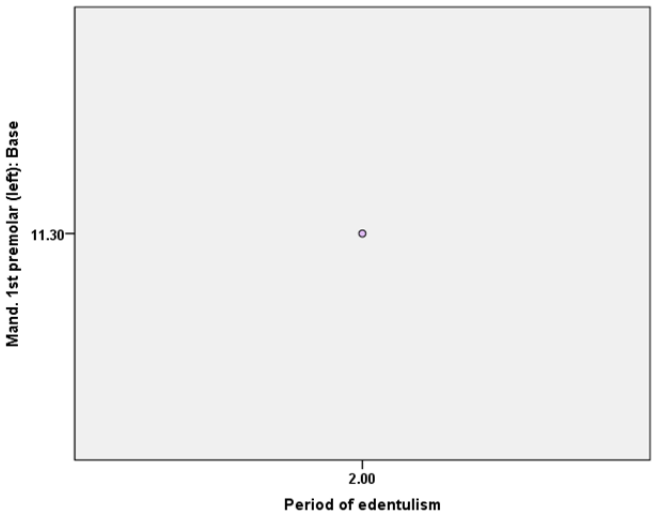


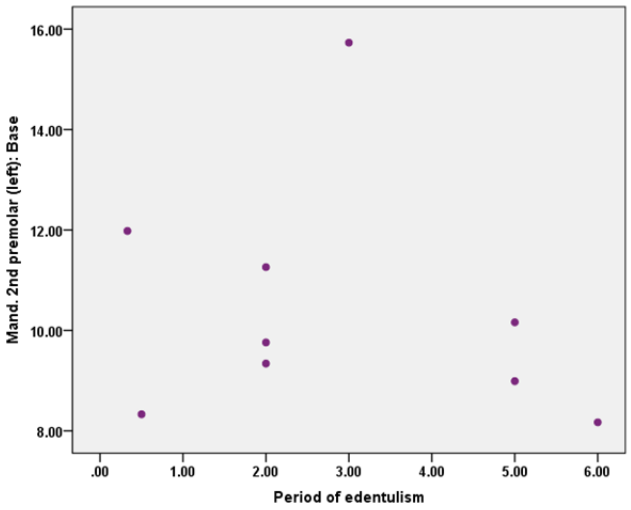
RESULTS:

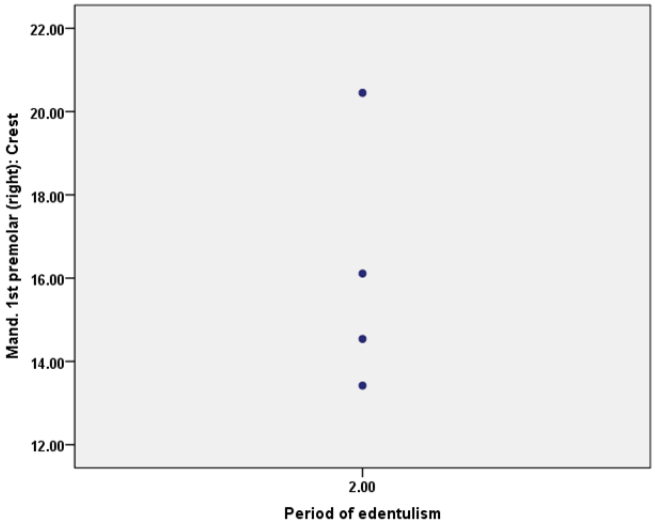
A total of n= 21 patients were assessed by CBCT, with 13 females and 8 males.Of the 21 patients assessed by CBCT analysis the average distance from mandibular 1st premolar was 15.9mm from the crest of the edentulous ridge and 10.44mm from the base. Similarly average distance from crest of edentulous space and base of mandible for mandibular second premolar was 15.46mm and 13.65mm.

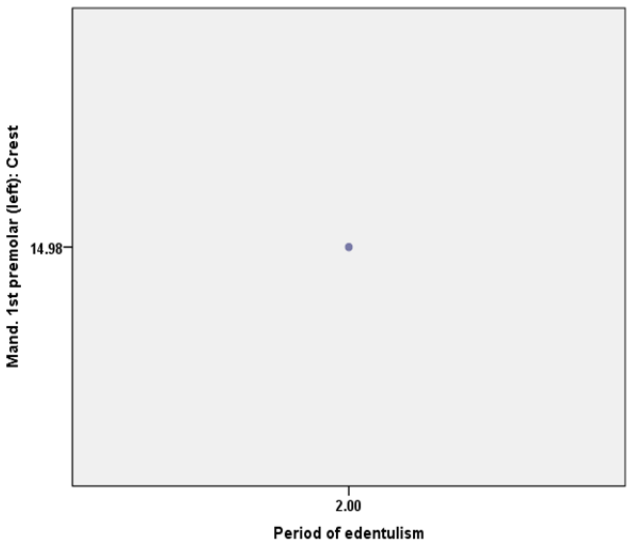
		Mand. 2nd premolar (left): Base	Mand. 1st premolar (left): Crest	Mand. 1st premolar (left): Base	Mand. 1st premolar (right): Crest	Mand. 1st premolar (right): Base	Mand. 2nd premolar (right): Crest	Mand. 2nd premolar (right): Base
Mand. 2nd premolar (left): Crest	Correlation	.293	.	.	.	.	.868	.403
	P-Value	.444	.	.	.	.	.331	.736
	N	9	0	0	1	1	3	3
Mand. 2nd premolar (left): Base	Correlation		.	.	.	.	.863	.411
	P-Value		.	.	.	.	.337	.731
	N		0	0	1	1	3	3
Mand. 1st premolar (left): Crest	Correlation			.	.	.	.	.
	P-Value			.	.	.	.	.
	N			1	1	1	0	0
Mand. 1st premolar (left): Base	Correlation				.	.	.	.
	P-Value				.	.	.	.
	N				1	1	0	0
Mand. 1st premolar (right): Crest	Correlation					-.559	.[a]	.[a]
	P-Value					.441	.	.
	N					4	0	0
Mand. 1st premolar (right): Base	Correlation						.[a]	.[a]
	P-Value						.	.
	N						0	0
Mand. 2nd premolar (right): Crest	Correlation							.417
	P-Value							.178
	N							12

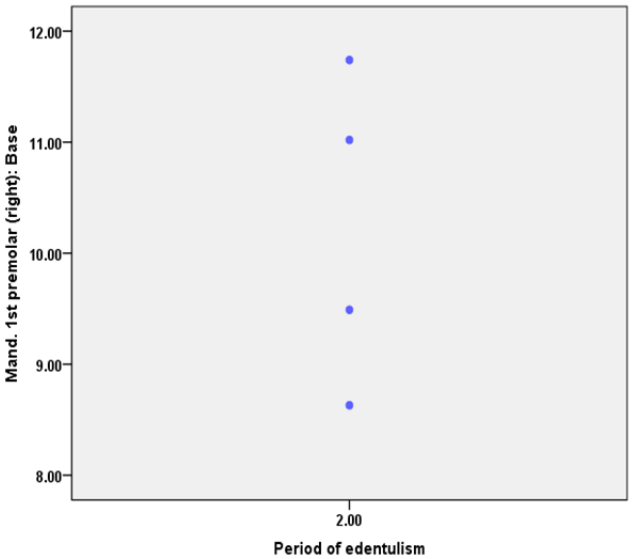

Mand. 2nd premolar (left): Crest
20.00
18.00
16.00
14.00
12.00
10.00
.00
1.00
2.00
3.00
4.00
5.00
6.00
Period of edentulism

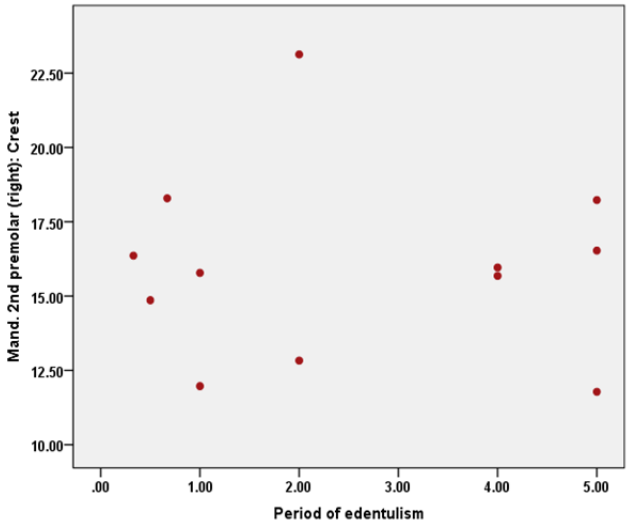

Mand. 1st premolar (left): Base
11.30
2.00
Period of edentulism

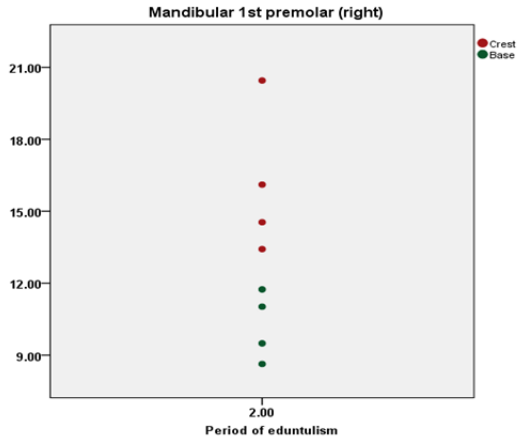

Mand. 2nd premolar (left): Base
16.00
14.00
12.00
10.00
8.00
.00
1.00
2.00
3.00
4.00
5.00
6.00
Period of edentulism

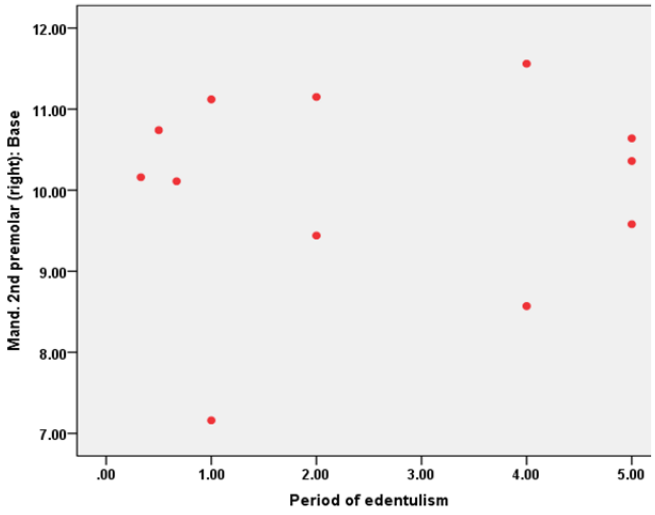

Mand. 1st premolar (right): Crest
22.00
20.00
18.00
16.00
14.00
12.00
2.00
Period of edentulism

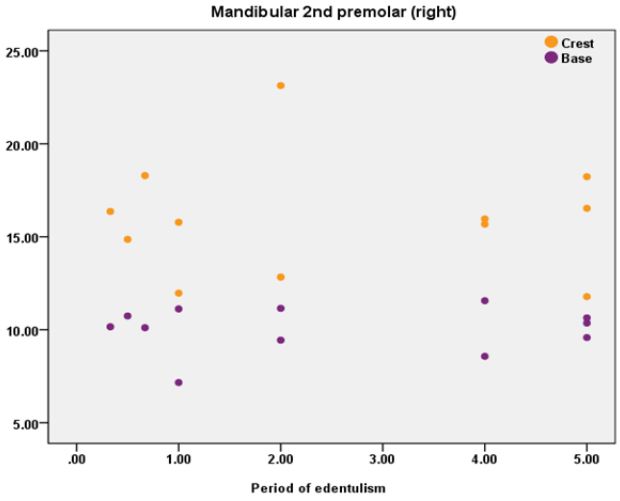

Mand. 1st premolar (left): Crest
14.98
2.00
Period of edentulism

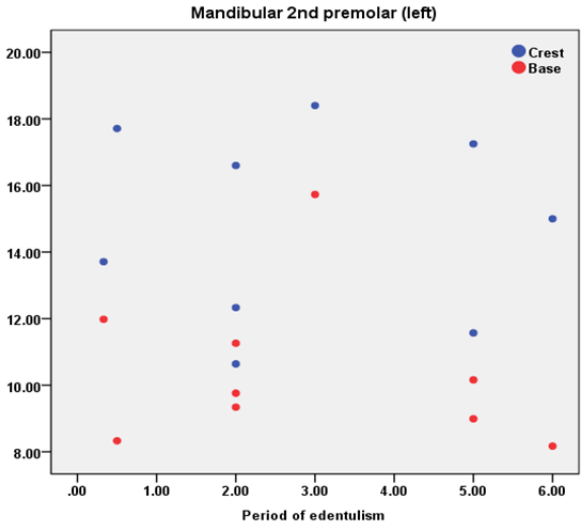

Mand. 1st premolar (right): Base
12.00
11.00
10.00
9.00
8.00
2.00
Period of edentulism











Discussion

Twenty one CBCT scans were reviewed in this study. The subjects varied from age 20-64 years of age. The subject pool was predominantly female which was unintentional as the CBCT scans were randomly selected from existing scans from the Implantology Department of SaveethaDental College & Hospitals.

Meaasurements were obtained from the superior aspect of mental foramen to the crest of the edentulous ridge in relation to mandibular 1st and 2nd premolars and from the lower aspect of the mental foramen to the base of the mandible. On average the mental foramen was closest to mandibular 2nd premolar.

Conclusion

The use of CBCT has proven itself to be a precise tool for measuring in three dimensions. Studies show that CBCT has an error of less than 0.6% especially when measuring mandibular anatomy [15]. Application of such technology has allowed this research to elucidate the relative positions of mental foramina. Of the 21 patients assessed by CBCT analysis the average distance from mandibular 1st *premolar* was 15.9mm from the crest of the edentulous ridge and 10.44mm from the base. Similarly average distance from crest of edentulous space and base of mandible for mandibular second premolar was 15.46mm and 13.65mm.

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