



## BUCCAL CORTICAL BONE THICKNESS MEASUREMENT USING CBCT: A CROSS SECTIONAL STUDY

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### ABSTRACT

**Introduction:** Accurate buccal cortical one thickness is required is required in various procedures like miniplates and monocortical screw fixation during treatment of mandibular fracture. It is aalso evaluated during fixation of cortical implants. With the innovation of CBCT accuracy of these measurements has increased greatly.

**Material and methods:** The retrospective study of 120 cbct scan 60 males and 60 females was done. Buccal cortical plate and trabecular bone thickness were measured at following locations : Canine ( C ) First Premolar ( PM ) , First molar ( M1) and Second Molar (M2). Measurements were made using a digital ruler aligned perpendicular to the cortex in cross-sectional views at the above locations. A statistical analysis was carried out using (SPSS) version -20 software. The means and standard deviation of data obtained was calculated.

**Result:** Among all the areas evaluated , width was greatest at the second molar region with  $4.53 \pm 1.51$  at the level of mid apical third of the tooth root,  $6.99 \pm 1.07$  at the level of root apex,  $5.23 \pm 1.45$  at the level of inferior alveolar nerve canal.

**Conclusion:** Buccal cortical thickness measurement should be imperative before treatment of mandibular fractures and for preoperative assessment of cortical implant fixation for succesfull treatment outcome.

### KEYWORDS :

#### INTRODUCTION

Surgical procedures in the mandible demand most accurate preoperative assessment of vital structures in the working field. The distance from outer ie. (buccal) bony cortex to the tooth root and the distance from the outer cortex up to the nerve canal play an important role in treatment planning and healing after operative procedure. Usually, the miniplates and monocortical screws are required for fixation of mandibular fractures. Such procedures require the assessment of proper bone thickness of buccal cortical plate. After champy *et al* researched, miniplate fixation of the mandibular fracture has become the standard and most widely used technique due to high level of elasticity and malleability<sup>1</sup>. Nowadays, miniplate fixation of mandibular fractures along the ideal lines of osteosynthesis is considered to be a standard and most widely used technique for oral surgeons. Fixation of monocortical screws in outer bony cortex of the mandible is enough to support the strains produced from the muscles of mastication<sup>2</sup>. Monocortical screw related tooth root trauma has been frequently reported in the literature<sup>3</sup>. During preoperative planning of mandibular fracture the knowledge of buccal cortical bone is critical. In conditions where implant placement is required , primary stability is necessary for osseointegration and is highly dependant on cortical bone width. Patients who have thick cortical bone, surrounding a cancellous bone is considered adequate for implant stability<sup>4</sup>. In cases of ramus grafts usually a graft is provided which is longer in length but not as thick as symphysis graft due to proximity of IANC towards buccal surface of external oblique ridge .Autogeneous bone grafts are considered as gold standard in alveolar ridge augmentation<sup>5</sup>. For orthodontic purposes and buccal tooth movement evaluation of buccal bone thickness is considered an important factor<sup>6</sup>. A lot of research has been carried out in the field of buccal cortical bone width measurement. With the advent of CBCT it was imperative to carry out such a study in our region ie. Jharkhand This was done

because of the increase in no of accidents and subsequent treatment of the fractured mandible by screws and plates. The rationale for this study was to determine the thickness of mandibular cortical bone and the distance of tooth roots and inferior alveolar canal to the outer cortex in dentate adults of Jharkhand Population employing Cone Beam Computed Tomography.

#### MATERIALS AND METHODS

A radiographic anatomical study was conducted on toothed adult patients who has undergone CBCT scan of the mandibular region for assessment of wisdom teeth prior to surgery at Hazaribag College of Dental Sciences and Hospital, Jharkhand. Exclusion criteria included any abnormalities that would affect bone thickness as any bone diseases, mandibular fractures tooth loss or any growth alterations . A healthy 120 male (60) and female(60) subjects between age 25 to 45 years were evaluated. A written consent was obtained from all patients to perform CBCT while each medical records contained another signed consent possibly for data usage in the other purposes. 120 CBCT scans were made following a strictly standardized procedure.

Buccal cortical plate and trabecular bone thickness were measured using OnDemand 3D™ Dental software (Cybermed Inc., Finland). One investigator carried out all the measurements . All the measurements were obtained at the following locations ie : Canine ( C ) First Premolar ( PM ) , First molar ( M1) and Second Molar (M2). Measurements of the buccal cortical plate and the distance from the outer cortex to the tooth root or the inferior alveolar canal (cortical plate and trabecular bone thickness) were taken for the locations C and PM1 at following levels: cortical plate thickness at the level of the midpoint of the midapical third of the root, cortical plate thickness at the level of apex, cortical plate and trabecular bone thickness at the level of the midpoint of the midapical third of the

root and cortical plate and trabecular bone thickness at the level of apex. In addition, for locations M1 and M2, the following levels were also measured: cortical plate and trabecular bone thickness at the level of inferior alveolar canal. Measurements were made using a digital ruler aligned perpendicular to the cortex in cross-sectional views at the following locations after tracing the mandibular nerve on either side. (SPSS) version -20 was used for statistical analysis. The means and standard deviation of data obtained was calculated.

## RESULTS

Amongst all the regions evaluated, the cortical plate was widest at the 2nd molar region.

### Cortical Bone Thickness :

(I) Assessment of cortical bone : The assessment value for the cortical plate thickness were highest for the second molar region with  $2.82 \pm 0.90$  at the level of mid apical third,  $3.34 \pm 0.78$  at the level of root apex,  $2.59 \pm 0.53$  at the level of inferior alveolar nerve canal (II) Assessment of width of cortical plate and trabecular bone ie distance from the outer cortex to the tooth root and inferior alveolar canal. Amid all the areas evaluated, width was greatest at the second molar region with  $4.53 \pm 1.51$  at the level of mid apical third of the tooth root,  $6.99 \pm 1.07$  at the level of root apex,  $5.23 \pm 1.45$  at the level of inferior alveolar nerve canal.

## DISCUSSION

Due to increasing cases of road traffic accidents and concomitant facial injuries in the state of Jharkhand, a large number of surgeries pertaining to placement of monocortical screw in mandible take place. These procedures usually require the assessment of cortical bone thickness in mandible. Screws are used to anchor miniplates to bone; therefore, it is important to know the distance from the outer cortex to the tooth apices and to the inferior alveolar canal to avoid injuring these structures<sup>7</sup>. In Jharkhand population, there is dearth of information about the cortical bone thickness of the mandible as well as the distance from the outer cortex to the tooth root and inferior alveolar canal. The ideal line of osteosynthesis (where the screws are supposed to be placed) frequently overlaps the tooth roots and nerves. With a uniform thickness of 0.9mm to 1.0mm, miniplates have been manufactured in different sizes<sup>8</sup>. 5-7mm long screws have been advocated to be used for fixation in outer mandibular cortex, by various authors<sup>9, 10</sup>. A few studies have reported neurological injuries resulting from placement of 5-7mm long screws. So, the present study was carried out to provide information about the cortical width of buccal bone, To determine correct length of monocortical screws for their placement in the studied population. Additionally, To determine the thickness of buccal cortical plate in relation to the inferior alveolar canal. To determine the thickness of buccal cortex for initial implant stability. To assist planning for autogenous bone grafts from the external oblique ridge area<sup>11</sup>. A CBCT machine was used because CBCT accuracy for linear measurements has been verified. Our results demonstrate that at the canine, first premolar, first molar and second molar, the cortical plate thickness measured at different vertical levels as well as the distance to the tooth root and inferior alveolar canal may predict the risk of injury to the roots and the canal. The results of our study are similar to the results found by Kataranji *et al*<sup>12</sup>, Leong *et al*<sup>11</sup>. However, in two other studies, where the mean cortical thickness in the mandible at the mental foramen was measured, the results were slightly higher than the results of the present study. These differences may be accounted for by the width of marrow spaces in different races. Deguchi *et al* studied the mean thickness of the cortical plate using CT scans for miniscrews used for anchorage in orthodontic treatment<sup>13</sup>. The cortical thickness ranged from 1.3 to 2.0 mm in the premolar and molar, which was similar to our result.

To conclude, this study showed that the use of 4mm or less size screws carries the least risk of injury to the tooth root and nerve<sup>7</sup>. But further studies incorporating larger sample sizes are needed to determine the stability of fixation with 3-4mm screws.

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