Dental implants in bilateral bifid canal and compromised interocclusal space using cone beam computerized tomography

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Abstract
Knowledge of various anatomic landmarks is pivotal for important success. Bifid canals pose a challenge and can lead to difficulties while performing implant surgery in the mandible. Bifid canals can be diagnosed with panoramic radiography and more accurately with cone beam computerized tomography (CBCT). This case report details the placement of the implant in a patient with bilateral bifid canal and compromised interocclusal space, which was successfully treated using CBCT.

Key words: Cone beam computed tomography, mandibular canal, radiography, variations

INTRODUCTION
Implants are the norm of the day and they have changed the face of dentistry in the past decade. Treatment planning is of utmost importance in implant dentistry. The available height and width of the residual alveolar ridge are crucial for implant placement in both maxilla and mandible. In addition, the knowledge of anatomical landmarks, course of the inferior alveolar nerve/mandibular canal is pivotal for implant success. The structural variation—bifid mandibular canal (BMC) can have implications in mandibular anesthesia, extraction of impacted third molars, and placement of implants, orthognathic, and surgical reconstruction. BMCs were considered to be rare as the reported incidence of this condition reported using panoramic radiography (orthopantomogram [OPG]) varies from 0.4,[1] 0.08,[2] to 0.9%.[3] However with the advent of cone beam computerized tomography (CBCT), they have been identified frequently, with the incidence being in the range of 15.6-64.8%.[4-7] Failure to identify these anatomical variations can lead to complications such as traumatic neuroma, paraesthesia and bleeding. The use of CBCT can aid us in good preoperative planning and prevent adverse outcomes. CBCT scores over OPG’s as it produces three dimensional images with superior resolution.

Furthermore, interarch distance dimension must be clearly visualized before implant placement. Many methods are available for additional gain in interocclusal space—intentional root canal treatment with a shortened prosthesis, orthodontic intrusion of the extruded teeth, or posterior maxillary segmental osteotomy (PMSO) This case report details the placement of implant in a patient with compromised interocclusal space and as well as bilateral BMC, which was identified using panoramic radiography and CBCT.

CASE REPORT
A 48-year-old female patient approached our clinic for the replacement of missing teeth in relation to the left posterior mandible. Medical history revealed hyperthyroidism past 5 years, for which the patient was under medication.

Presurgical evaluation
On intraoral examination, missing 36, 37, 46, 47 were identified [Figures 1 and 2] with inadequate intra-occlusal clearance in relation to 3rd and 4th quadrant. The treatment options were explained to the patient. Routine blood and radiographic investigation were carried out. The OPG showed unusual bifid inferior alveolar canal on both sides [Figure 3]. Since we had planned to replace 36, 37 with implants, a CBCT were taken for more accurate information. The exposure parameters of the BCT unit were, 90 kvP of tube voltage, with 10 mA of tube current and the exposure time was set at 14.20 s with a 360° X-ray source and images with an axial thickness of 200 µm were taken. Highly variable mandibular canal anatomy was seen bilaterally. On the left side, mandibular canal appeared to bifurcate lingually, and the superior branch further divides into multiple branches in 36, 37 region. The uppermost branch is just 2.3 mm below the alveolar crest. On the right side the mandibular canal bifurcates at the level of 48 and the nerve continues as a larger superior branch and a smaller inferior branch up to the mental foramen [Figures 4 and 5]. The height and the width of alveolar bone were also derived from the CBCT [Table 1]. The patient was informed about the presence of this anatomical aberration, an informed consent obtained from the patient.

Surgical protocol
Radiographic determination of final placement was done with the help of surgical stent. Presurgical preparation protocol was followed, and surgery was carried out under conscious sedation using midazolam. Local anesthesia was achieved using plain xylocaine. A full thickness mucoperiosteal flap was reflected in relation to 36, 37. Osteoplasty was performed, and a stent was positioned. The sequential pilot drill used to prepare the osteotomy site and Nobel Groovy 5 mm × 10 mm in 36 region and 5 mm × 11.5 mm in 37 region was placed [Figure 6] and the flap was secured with vicryl sutures. The implant was angulated buccally to avoid the damage to the nerve. Postoperative instructions were given and the implant site healed uneventfully.

Prosthetic rehabilitation and follow-up
Follow-up was done at three months interval and 6 months, screw retained prosthesis was loaded [Figure 7]. Clinical
and radiographic examination at 6 months, 1 year, and also 2 years revealed no significant changes.

DISCUSSION

The BMC is a variation in the anatomy of the mandibular canal, and each one may house a separate neurovascular branch. Identification and knowledge of the configuration of the BMC are indispensable in surgical procedures to avoid surgical as well as postsurgical adverse consequences.

Developmentally, as the fusion of three individual nerve branches start, intraosseous membranous ossification happens surrounding the nerve. Rarely, the nerves do not merge completely, bifid or double mandibular canals can occur. Sometimes, the mental foramen opening also differs which may also make it difficult to predict the course and position of inferior alveolar nerve. Langlais et al. have used panoramic radiography to classify mandibular canals. The first included BMCs extending to the area surrounding the third molar or to the tooth itself; the second included BMCs arising from the same foramen but forming two separate canals which rejoined to form a single canal anteriorly; the third type included a combination of the first two types; and the last type included two radiographically separate canals with separate origins that eventually fused into a single canal anteriorly. Naitoh et al. have used CBCT imaging, and he classified into four types: Retromolar, dental, forward, and buccolingual canals.

In this case, the bilateral bifid inferior alveolar nerve was seen to extend until the body of the mandible and thus it might be appropriate to classify it as Langlis type II variation. Moreover, on the right side, the nerve sprouted minor branches in 36, 37 region. Using CBCT, we were able to identify accurately the position of the main trunk and the branches, which helped us to avoid these terminal branches while placing the implant. Another challenging problem we faced was reduced interocclusal distance. Punde et al. 2013 reported series of 5 cases with superiorly placed maxilla wherein PMSO was performed to correct the compromised interarch distance. As sufficient bone for alveoloplasty was available, we decided to use this conservative approach to gain the required interocclusal space. Furthermore, orthodontic treatment helped to gain more space for the placement of implants.

| Region of interest (teeth no) | Height of alveolar bone (mm) | Crestal width (mm) | Midlevel width (mm) |
|-----------------------------|-----------------------------|--------------------|--------------------|
| 15                          | 24.9                        | 8.6                | 10.4               |
| 26                          | 19.9                        | 9.2                | 11.7               |
| 36                          | 3.0                         | 7.5                | 9.5                |
| 37                          | 2.3                         | 6.2                | 8.5                |
| 46                          | 13.1                        | 10.8               | 11.6               |
| 47                          | 13.5                        | 8.6                | 14.4               |

Table 1: Height and width of alveolar bone

Figure 1: Missing 46, 47

Figure 2: Missing 36, 37

Figure 3: Orthopantomogram showing bifid canal

Figure 4: Computerized tomography of bifid canal
Screw retained crowns were opted as they provide better retention in limited interarch space. The primary advantage of a screw retained superstructure is the lower profile retention of the abutment system. It has also been shown that screw retained crowns are required in situations when limited interarch space dictates an abutment shorter than 5 mm.\(^{[10]}\)

To conclude, the mandibular canal is of extreme importance in implant placement. CBCT scans provide clearer images of the mandibular canal when compared to digital panoramic radiographs since CBCT images are free of overlap and other problems inherent to panoramic radiographs. Therefore, recognition of its location through CBCT should be mandatory during surgical planning to avoid adverse surgical and post-surgical consequences.

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### Conflicts of interest
There are no conflicts of interest.

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