CASE REPORT

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The role of CBCT in diagnosing and managing cleft lip and palate

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ABSTRACT

Objectives: Cleft lip and palate (CLP) are one of the most common types of congenital maxillofacial lesions. Cleft lip and palate patients often deal withspeech, masticatory and hearing problems, dental and craniofacial anomalies, and psychosocial issue. The aim of this study is to determine the role of cone beam computed tomography (CBCT) in diagnosing CLP.

Case Report: A 25-year-old female was referred to dentomaxilllofacial radiology department in Universitas Padjadjaran Dental Hospital for a CBCT examination of a cleft palate. Three-dimensional image analysis provides superior and more detailed information compared with conventional plain two-dimensional (2D) radiography, with the added benefit of 3D printing for preoperative treatment planning and regenerative therapy. The result showed a radiolucent area between teeth 21 and 23, agenese teeth 22. These findings led to cleft palate unilateral complete at sinistra region. CBCT imaging provides a detailed picture of the cleft in three dimensions view that can helps for determining the treatment plan based on the classification of cleft lip and palate.

Conclusion: Available evidence implies that 3D imaging methods not only can be used for documentation of CLP patients, but also can determining the treatment plan. 3D CBCT radiograph are more informative than conventional 2D.

Keywords: *Cleft lip and palate, CBCT, craniofacial anomalies, panoramic*
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INTRODUCTION

Cleft lip and palate (CLP), a congenital abnormality with significant clinical and psychosocial consequences, can be a solitary deformity (nonsyndromic origin) or part of a collection of numerous congenital defects (syndromic origin). Clinical manifestations of CLP children include midfacial development deficiency linked with a retruded maxilla, facial asymmetry, maxillary constriction, or morphological abnormalities in the nasal cavity, and velopharyngeal insufficiency.[1,2] These anomalies are primarily caused by congenital abnormality, however surgical scars may also cause face deformities. Thus, the diagnosis and treatment of cleft facial abnormalities should be based on an interdisciplinary approach, with radiologic study playing an essential role.[3]

A clinical evaluation in a specialized center for craniofacial malformations should be undertaken soon after birth, and comprehensive coaching of the parents by a multidisciplinary team will seek to explain the essential protocols for diagnosis and treatment. For the purpose of surgical or orthodontic therapy, radiological examinations can be advised at various phases of a child's development to track the growth of their teeth and bones.[4] The most used imaging modality for diagnostic and treatment is currently an orthopantogram combined with an occlusal view, however, accurate assessment of cleft size and determination of bone volume required for the alveolar graft is difficult due to distortion, structural overlap, limited identifiable landmarks, and most importantly, no volumetric information. These imaging limitations can lead to lower prognostic accuracy, which can lead to overtreatment or inability to address clinically unsuccessful bone graft treatments.[5] Furthermore, 3D imaging can be used to overcome existing limitations.

Cone beam computed tomography (CBCT) has become more popular over the past several decades as an imaging modality. CBCT enables the high-definition visualization of anatomic structures through sections made in the sagittal, axial, or horizontal planes. Other benefits of CBCT include a lower radiation dose, lower cost, and a smaller physical footprint compared to other CT methods.[6,7] In this stage of the year, CBCT is used to plan and assess orthognatic surgery once bone development is complete. As a result, CBCT emerges as the key

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instrument in the diagnostic process. In addition to the position and connection of the jaws, it is utilized to evaluate the facial aspect, asymmetry, and/or volume of the pharyngeal airway.[8–10] A transverse maxillary deficit, which impacts the occlusion and facial aspect may arise when the cleft scars affect the maxilla's growth. CBCT can be used to evaluate this deficiency and provide a recommendation for rapid maxillary expansion (RME).[11] By using CBCT, the outcomes and stability over time can also be evaluated. The aim of this study is to determine the role of cone beam computed tomography (CBCT) in diagnosing CLP.

CASE REPORT

A 25-year-old female was referred to dentomaxillofacial radiology in Universitas Padjadjaran Dental Hospital for CBCT examination of a cleft palate with the presence of missing teeth due to follow-up treatment. The result showed a radiolucent area between teeth 21 and 23, agenese teeth 22. The bone does not appear to close between teeth 21 and 23. These findings led to a cleft palate unilateral complete at sinistra region. CBCT imaging provides a detailed picture of the cleft in three dimensions view that can help for determining the treatment plan based on the classification of cleft lip and palate.

DISCUSSION

Cleft lip and palate (CLP) are a craniofacial abnormality caused by incomplete facial development. The alveolar process, palate, and lip are the areas most damaged; the alveolar process's osseous defect has the greatest involvement. Throughout early childhood until adulthood, children with this abnormality need multidisciplinary care. In several studies as reported by Kadam et al. (2013)[12] CLP causes clinically significant deficiencies such as microdontia. Qureshi et al. (2012)[13] reported that cleft can cause ectopic eruption of primary lateral incisors close to or within the cleft, as well as palatally erupting permanent canines on the alveolar cleft side. Permanent incisor eruption may occur later. CLP children might develop midfacial

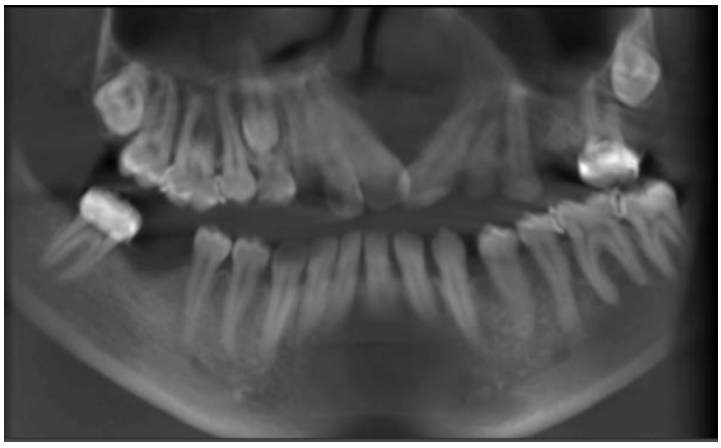

Figure 1. A panoramic reformatted image acquired from a CBCT examination shows a left CLP with the dental anomalies: mesioversion of the upper lateral left incisor and hypodontia, with an absence of the lateral left incisor

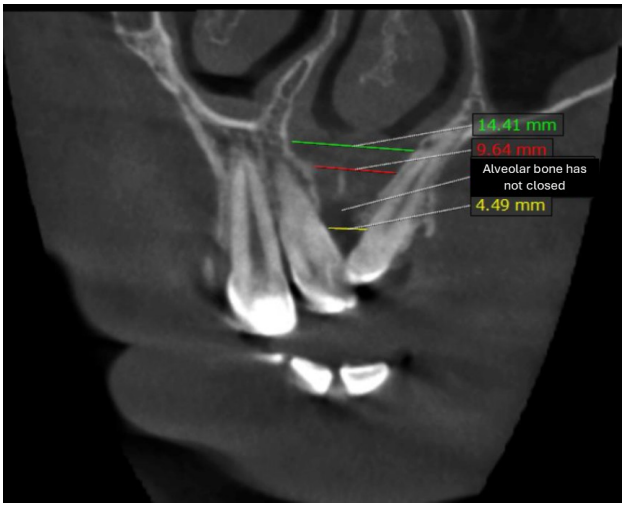

Figure 2. Coronal CBCT examination shows the size of the bone defect and the location of the teeth in relation to the CLP

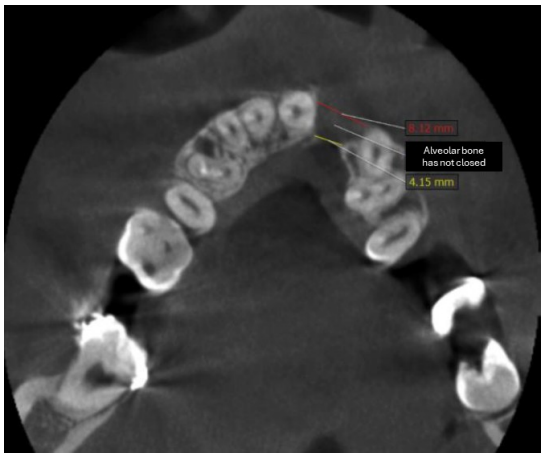

Figure 3. Axial CBCT examination shows the bone defect and an absence of the lateral left incisor

growth limitation due to facial abnormalities, maxillary constriction, nasal airflow limitations, and velopharyngeal insufficiency.[14–16] In this article as shown in figure 1, hypodontia, impacted teeth, and alveolar bone that has not closed are found using CBCT. In the coronal CBCT examination as shown in Figure 2, it was found that the bone that had not closed in the alveolar area up to the nasal cavum amounted to approximately 9.64 mm, meanwhile, figure 3 shows the presence of bone from teeth 21 to 23 or the distal mesial direction, which is about 8.12 mm. However, the radiographic assessment results provide an initial basis for determining whether preliminary actions for additional therapy are required.

The alveolar boundary condition has been characterized as the height, depth, and shape of the alveolar bone.[17] In over 90% of the cleft children, the alveolar border condition was altered in the cleft area. This may be the cause of the recommendation for a CBCT scan prior to beginning orthodontic treatment or in situations where tooth mobility is necessary. As Shown in Figure 2 dan 3, the distance showing the discontinuity of the labial and buccal plates extends to the inferior wall of the nasi cavum. These conditions near the alveolar barrier should be viewed as a dynamic structure that can be altered by orthodontic therapy.[18,19] Hence, when it is helpful in estimating the volume of the bone graft and can also show changes in the cortical bone and the three-dimensional structure of the alveolar a bone, a CBCT scan would be more appropriate prior to the planning of the bone grafting procedure.

The use of CBCT in cleft patients might start in the initial years of life to represent and aid in diagnosis. In this case, the patient is 25 years old, and according to Dinu et al. in 2022, bone growth is complete at that age, therefore orthognathic surgical planning is normally performed.[20] As a result, CBCT has become valuable tool in the diagnostic process. It evaluates jaw position, pharyngeal airway capacity or volume, face aspect, and asymmetry. Furthermore, for quantitative evaluations of buccal and lingual alveolar bone thickness and level, CBCT demonstrated good accuracy and reproducibility.

Studies reveal that CBCT radiation exposure is relatively modest when compared to other modalities, despite criticism that it has a larger radiation dosage than typical 2D imaging techniques (lateral cephalogram, panoramic). CBCT imaging is more effective than 2D radiology in revealing the 3D architecture of jaws. It has been documented that CBCT is helpful at various phases of cleft anomaly diagnosis and treatment. The recommendation for CBCT examinations was consistent across all age groups of children with cleft lip, with the exception of those under six years old. The findings may indicate that there was no age-appropriate standardized protocol followed for the CBCT evaluation.[21] Furthermore, the ages at which the CBCT irradiation was initiated did not significantly differ from one another. However, between the ages of eleven and fifteen, the greatest number of CBCT exposures was advised.

CONCLUSION

Treatment must be based on an accurate diagnosis at every step for it to be helpful. Current research suggest that 3D imaging tools can be used not only to identify CLP patients, but also for accurate evaluation and diagnosis. Following a decade of CBCT planning of the bone graft or estimation of the transversal deficiency might be performed, followed by orthognathic surgery planning after twenty years. Future research should address the study's vulnerabilities.

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FOOTNOTES

All authors have no potential conflict of interest to declare for this article. Informed consent was obtained from the patient for being included in this case report.

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