

Exploring accuracy and feasibility in 2-D & 3-D imaging techniques for assessment of airway in OSMF patients- A review

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Abstract

Lateral Cephalometry (LC) and Cone Beam Computed Tomography (CBCT) are 2 time tested imaging techniques which have been utilized for identification of pathologies and morphometric analysis of various oral structures. LC gives a 2 dimensional view of 3 dimensional structures thereby assisting in clinical diagnosis and progression of diseases. CBCT gives a 3 dimensional image thus reducing the error and giving a more closer than natural image. Oral Submucous Fibrosis (OSMF) has been studied in depth in all aspects. Our review aimed at exploring the use and efficacy of LC in CBCT in measuring airway in OSMF patients.

Keywords: CBCT, OSMF, Velum, Cephalometry.

Introduction

Lateral cephalometry (LC) is a standardized sagittal X-ray technique of head and neck. A literature search in pubmed revealed that LC has been used extensively for assessing airway in Oral Sleep Apnea Disorder (OSAD), obstructive hypopnea, upper airway resistance syndrome and different malocclusion cases.¹⁻³ Currently, CBCT plays a key role in comprehensive imaging of orthodontic cases giving much better results than LC and panoramic images. Cone Beam Computed Tomography (CBCT) technique is used when simple X-rays or LC is not sufficient and image of highest precision order is needed. Recently its role in the morphology of soft palate has also been explored. This has been especially useful to assess the functional competency of patients with Oral Submucous Fibrosis (OSMF).^{4,5}

Technique

LC is taken by a standardized technique. The length of soft palate is measured from posterior nasal spine to the tip of the uvula (resting soft palate). This gives a 2 dimensional image of a 3 D object.

CBCT

CBCT images are recorded by digital radiographic machine (Example: Sirona Orthophos SL CBCT), 90 Kv, 10mA, exposure time of 10 sec. The patients are positioned straight such that the Frankfurt horizontal line lies parallel to the floor. Patients are informed to breathe through their nose with teeth occluding in maximum intercuspation. Images are stored as DICOM files.⁶

Morphological Patterns

Morphology of soft palate as discussed by You et al (2008) can be assessed by both methods. The various morphologies are {Type I- Leaf type, Type II- Rat tail type, Type III- Butt type, Type IV- Straight line type, Type V- S-shaped type, Type VI- Crook shape}.⁷

Need's Ratio

Critical ratio between soft palate length and nasopharyngeal depth.⁸

Evaluation of both techniques:

| Features | LC | CBCT |
|------------------------|---------------|---------------------|
| Equipment | Cheap | Bit expensive |
| Sophisticated software | Not required | Required |
| Image reproducibility | Not possible | Highly reproducible |
| Cost | Cheap | Slightly expensive |
| Radiation exposure | More | Less |
| Accuracy | Less accuracy | High accuracy |

OSMF

It's a chronic disorder has an illustrious presentation by limited mouth opening and fibrosis of the lining mucosa of the upper digestive tract involving the oral cavity, Oropharynx [OP] and commonly the upper third of the oesophagus. The fibrosis extending into Nasopharynx [NP] affects functions of Eustachian tube.⁹ Anatomically, the division of pharyngeal airway is demarcated by NP, OP, and laryngeal pharynx. There are numerous articles on calculating airway volume in Oral sleep apnea disorder (OSAD) and other orthodontic malocclusion cases.¹⁰ There is no literature available to show any variation in the volume of the complex upper airway (restricted to NP and OP) in relation with OSMF patients. An important consideration is that OSMF may have limited mouth opening and as such may pose challenges in intubation. Retrograde intubation becomes method of choice in such circumstances. Diminished volume of NP, OP may be due to airway constriction complicating intubation procedures. Cephalometric analysis being non-invasive, inexpensive can be performed to assess the upper airway area. This 2-

Dimensional technique may evaluate efficacy of pre-operative intubation procedures as well as give an idea about the reduced area of upper airway in OSMF patients which can have poor prognosis.¹¹

OSMF changes may lead to alterations in NP, OP volume which can be assessed by Cone Beam Computed Tomography (CBCT) accurately as compared to LC.

Other Imaging Modalities

Schwab RJ reviewed various upper airway imaging modalities namely, acoustic reflection, fluoroscopy, nasopharyngoscopy, cephalometry, conventional and electron beam CT and MR imaging with hard and soft tissue anatomic representations.¹²

It is seen that various image modalities are available to evaluate soft palate morphology, its length, its width and palatal depth, Need's ratio. CBCT seems to have promising results and give accurate measurements.

Conclusion

Moving towards the era of imaging where examination needs to be life like, CBCT may become a more acceptable diagnostic technique surpassing the other 2-dimensional techniques like LC.

Conflict of Interest: None.

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How to cite this article: Khare P, Reddy GVR, Gupta A, S Vijayta, Handa H. Exploring accuracy and feasibility in 2-D & 3-D imaging techniques for assessment of airway in OSMF patients- A review. *J Oral Med, Oral Surg, Oral Pathol, Oral Radiol* 2019;5(1):7-8.