

A New Approach to Preserve the Vertical Alveolar Height after Resecting Odontogenic Keratocyst using Biomedical Data Visualization and Surgical Simulation

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ABSTRACT:

Advances in CAD technology allow the import of medical data through CT, MRI in to CAD based medical soft wares and good graphics hardware has facilitated surgeons to model the patient's anatomy^{1, 2}. This 3D CT images allows the surgeon to evaluate a patient's hard and soft tissue deformity as a 3-dimensional whole, instead a series of 2 dimensional CT slices. Further manipulations of these data are used for diagnosis, preoperative surgical planning and surgical simulations³. Odontogenic keratocyst in mandible can be treated in various ways like enucleation with chemical cauterisation, resection etc^{4,5,6,7,8,9}. This would eventually result in loss of alveolar bone horizontally and vertically. Techniques which can avoid the bone loss during ablation of the lesion will be of great use. Understanding the pathological involvement and destruction of the bone with 3D and manipulating it with medical software can initiate the surgeon to modify his procedures in individual cases to preserve horizontal and vertical height of the alveolar bone without changing the basic principles in removing OKC.

A CT data of mandible was taken to evaluate the size and extent of the odontogenic keratocyst in a patient. In this case the CT data was reconstructed

in to 3 dimensional virtual object and various procedures were simulated. As the lingual cortex was not destructed it was decided to preserve the lingual cortex and to enucleate the lesion through buccal cortical resection followed by chemical cauterization of the lingual cortex. Late postoperative results after 1 year showed that the lingual cortical plate height was preserved and maintained. Thus biomedical data visualization and preoperative surgical simulation helps the surgeon by not only providing the complete pathologic anatomy of the surgical site but also helps the surgeon to modify the surgical approach to get good post operative results.

Patient and Methods

A 20 year old male patient came to our dept on 29.11.06 with a complaint of swelling over his left side lower jaw. The swelling was visible externally. Intraoral examination revealed a firm, diffuse swelling extending from 32 to 36 posteriorly. A CT mandible was taken in which a cystic lesion was identified. An incisional biopsy was performed and the histopathological diagnosis was confirmed as odontogenic keratocyst.

A CT data of mandible was taken to view the lesion 3 dimensionally. The conventional approach for

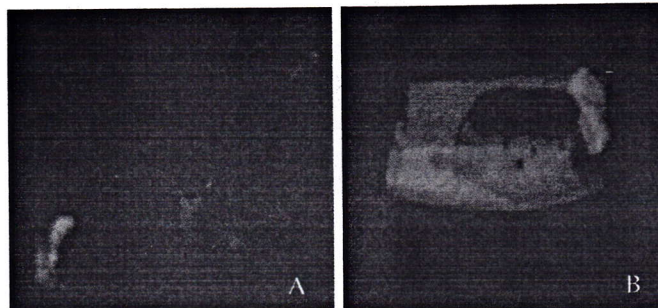
odontogenic keratocyst is intra oral transbuccal approach where after elevation of the mucoperiosteal flap, the buccal plate will be removed to approach the cyst. In some cases the buccal flap would have already been perforated through which the cyst can be enucleated. Though the approach differs, in most cases some of the lingual cortex also will be removed which will eventually leads to bone loss in vertical dimension. In this case, pre-operative 3D visualization and surgical simulation of the lesion (Fig 1A-B) opened a new avenue to approach the cyst for its removal. It has been found that the lingual cortex was not destroyed but the buccal cortex was destroyed and perforated, hence the lesion was enucleated by buccal cortical resection along the entire extent of the lesion exposing the whole lesion which then completely enucleated in toto with impacted tooth (Fig 2A-B). The lingual cortex was preserved, but burnished and chemically cauterized with carnoy solution (Fig 3). The wound was primarily closed with 3-0 catgut. The resected specimen was sent for histopathology to know the clear margins (Fig4)

Results

Post operative follow up after 1 year revealed no signs Of recurrence (Fig 5) and the intact lingual cortex without any reduction in its vertical height (Fig 6). Now the patient is undergoing dental rehabilitation.

Discussion:

It has been widely accepted that 3D CT data visualization helps in diagnosis and treatment planning ^{1,2}. In this instance it was not only useful in making diagnosis and treatment planning but also enabled the surgeon to treat the lesion in an innovative manner. This kind of approach is very useful as it preserves the height of the alveolar bone in a patient which is very difficult to replace, once lost. The conventional approach for odontogenic keratocyst depends on the extent of the lesion. Usually a mucoperiosteal flap from the sound bone will be raised and the involved teeth will be extracted, then the cystic lesion will be completely enucleated with resection of the adjacent buccal and lingual cortices though the lingual cortex was not involved because of poor understanding of the anatomy and the information about the extent of the lesion revealed by conventional techniques. This would eventually result in loss of vertical alveolar bone. But preservation of the vertical height of the alveolus as mentioned in this case is only possible by 3D data visualization. Hence it has been justified that preoperative 3D data visualization is not only important in complicated cases but should be done as a routine

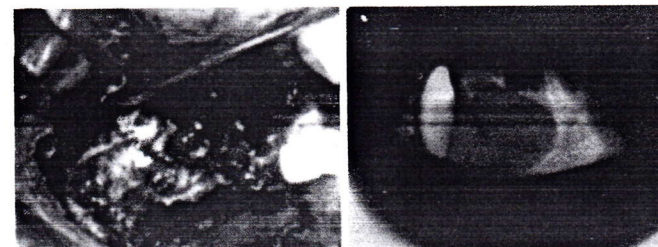


(Fig 1 A –B) Virtual surgical simulation



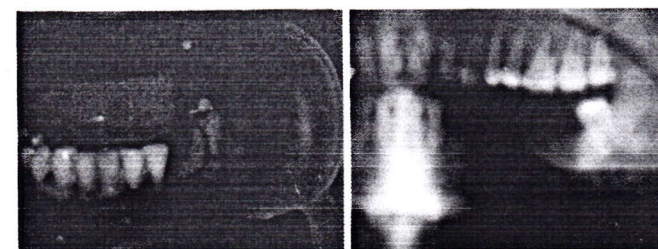
(Fig2A)Intra oral buccal window approach

(Fig2B) whole lesion completely enucleated in toto with impacted tooth



(Fig 3)Preservation and chemical cauterization of lingual cortex using carnoy solution

(Fig 4) Radiograph of resected specimen showing clear margins



(Fig 3)Preservation and chemical cauterization of lingual cortex using carnoy solution

(Fig 4) Radiograph of resected specimen showing clear margins

diagnostic procedure, so that the best treatment plan can be executed, which will enhance the quality of life of patients.

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