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RESEARCH ARTICLE

A COMPARATIVE STUDY OF IMAGING TOOLS IN THE SURGICAL MANAGEMENT OF MANDIBLE PATHOLOGY

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ABSTRACT: Objective. The objective of this study is to evaluate the usefulness of the best imaging modality out of Orthopantomogram (O.P.G.), Conventional CT and 3D CT Reconstruction, in the planning of surgical treatment of maxillofacial pathologies and comparing it with the actual pathology seen while operating. To evaluate visualization depicted through O.P.G, Conventional CT and 3D CT Reconstruction, with the existing lesion seen.Study design. Twenty patients with mandibular pathology were selected and all the Patients were subjected to Orthopantomogram (O.P.G.), Conventional CT scan (3mm cut) and 3D reconstruction of CT. All the radiographs were evaluated by the same surgeon for all 20 Cases. Each case was assessed for usefulness in evaluation of lateral extent, bucco-lingual extent, superior-inferior extent, contents of lesions and surrounding soft tissue, with the scenario seen on table. A scoring criteria was made and scores were given accordingly by the same surgeon evaluating the radiograph and performing the surgery. A surgical plan was proposed and patients operated upon accordingly. The specimens were examined physically and co-related with the imaging techniques.Result. OPG showed a 32.33% of overall usefulness as compared to 66% and 76.33% usefulness seen in conventional CT and 3D CT respectively. The 3D CT appears to be the most useful in all aspects of surgical planning with regards to Bucco-lingual, Superio-inferior & lateral extent evaluation. With regard to contents of lesions and surrounding tissues involvement the conventional CT is desirable. To evaluate tooth morphology and root resorption the OPG is a desirable adjuvant for a surgeon.

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Conclusion. The 3D CT scan appears to be the most useful tool in the surgical planning of pathological lesions with regards to evaluation of anatomical location and dimensions of the lesion. Regarding adjacent tissue involvement and content of the lesion, CT scan ranked high. But the fact cannot be denied that OPG not equally but contribute substantially in surgical planning.

Keywords: Orthopantomogram (O.P.G.), Conventional CT and 3D CT Reconstruction, mandibular Pathology

INTRODUCTION

The Oral and Maxillofacial region is a complex part of the anatomy of the human body. There are 206 bones in human skeletal system, out of which 22 are in this region. These bones are relatively small and are intricately arranged to constitute the facial skeleton. This complex structure includes joints, tissue planes and uniquely the dentition. The maxillofacial system can be affected by various pathologies like inflammatory, infectious, neoplastic (benign and malignant), osseous and osteolytic lesions. Considering the complexity of maxillofacial skeleton and various pathologies which could affect it, it is very important for the surgeon to have a detailed understanding of accurate location, extension of disease & dimension of pathology[1]. Knowledge gained through clinical examination is limited to arrive at a precise surgical plan. Radiological investigations are the only means of providing this important link. Ever since 1895 when Roentgen first discovered X-rays, the field of radiology has grown in leaps and bounds[2]. Many surgeons prefer different imaging tools and a documentary evidence is required as to which imaging technique would have maximum benefit and would help the most during surgical intervention. It was with this intention that this study was undertaken.

The aim of this study was to evaluate the usefulness, of the best imaging modality out of Orthopantomogram (O.P.G.), Conventional CT and 3D CT Reconstruction, in the planning of surgical treatment of maxillofacial pathologies and comparing it with the actual pathology seen while operating. To evaluate visualization depicted through O.P.G, Conventional CT and 3D CT Reconstruction, with the existing lesion seen.

MATERIALS AND METHODS.

20 patients were selected with lesions affecting mandible. Patients of all the age groups were included. Sample included both male and female. Cases with involvement of other bone than mandible were excluded from the study. All lesions irrespective of the nature of the pathology were included in the study. All the Patients were subjected to OPG, Conventional CT scan (3mm cut) and 3D reconstruction of CT imaging. After obtaining each of the radiographs, it was evaluated by the same surgeon for all 20 Cases. Each case was assessed for usefulness in evaluation of lateral extent, bucco-lingual extent, superior-inferior extent, contents of lesions and surrounding soft tissue, with the scenario seen on table. A scoring criteria (Table 1) was made as follows, score from 0 to 4 were given as follows:-

Table 1. Scoring criterion Scale

Exceptionally useful showing fine details	**Score 4**
Very useful	**Score 3**
Moderately Useful	**Score 2**
Minimally Useful	**Score 1**
No Diagnostic Value	**Score 0**

A surgical plan was made after proper assessment of the radiographs and clinical features. All the patients were operated under general anesthesia by the same surgeon along with the team and scoring was done post operatively by the same surgeon as per the scoring criteria mentioned, and documented.

In some instances, it was difficult for the surgeon to interpret the radiograph. In such situations, the service of other consultants were taken for assessment, which were also there in operating surgeons team. A (*) was assigned next to the score in the evaluation performa for which the skill of the other doctors were required to confirm the observations.

The results were computed, tabulated and compared between the three imaging tools, and were analyzed using Friedman test for evaluating the significance and the most useful tool which depicts actual existing condition on table, with regards to each parameters and overall usefulness. Additional information was also considered in the observation.

OBSERVATIONS

Case no.1

A 25 year old female patient came up with the complaint of swelling over her right face, of the duration of 3 years (fig.1). Subsequently history was taken and clinical evaluation was done (fig.2). Radio graphical investigations included O.P.G., CT scan (3 mm section) and 3D CT reconstruction (fig.3, fig.4, fig. 5).

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Figure 1.

Figure 2.

Figure 3.

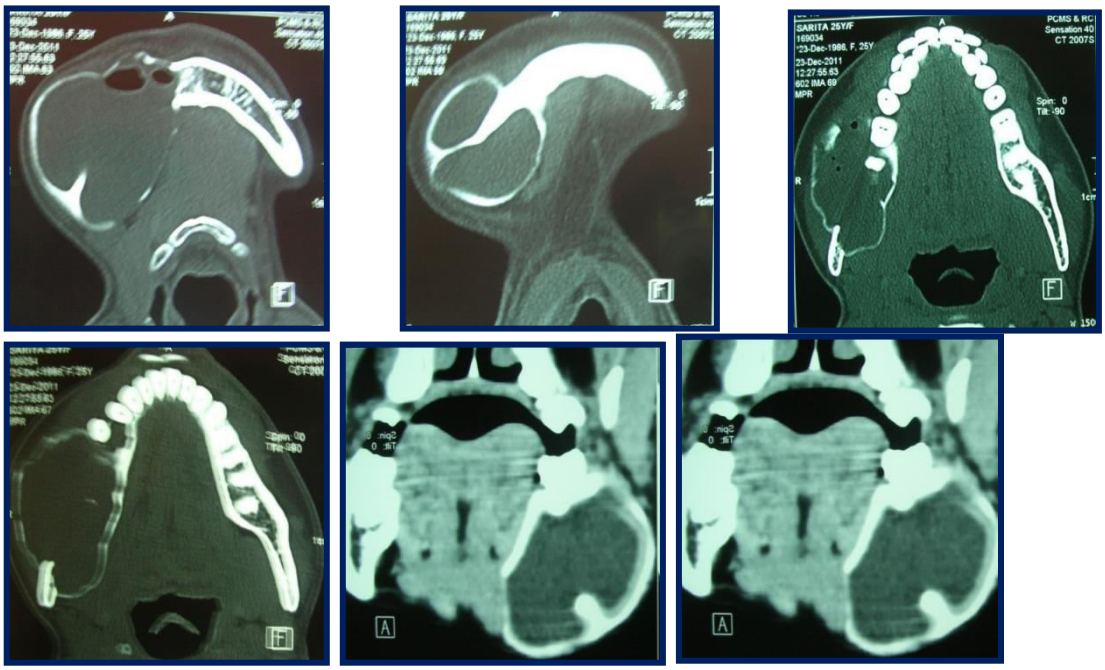

Figure 4.

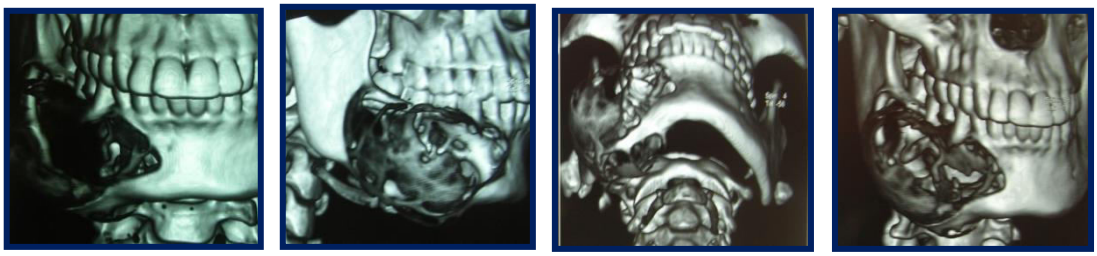

Figure 5.

Incisional biopsy was done, which gave the diagnosis of Ameloblastoma and subsequently surgical plan & reconstruction were proposed and patient was operated upon. After surgical exposure of the pathology, all the 5 parameters were taken into consideration and were evaluated upon. Figure 6 shows the resected mandible specimen, which was later examined physically and correlated with the radiographic images and later sent for histopathological evaluation.

Figure 6.

Figure 7

All the necessary and important protocols for surgical management were followed, for the benefit of the patient. Figure 7, shows the 6 months post operative healing of the patient.

The result and observation was tabulated and scoring was done as per the scoring criteria (Table 2)

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Table 2

EVALUATION OF IMAGING TOOLS WITH SURGICAL FIELD (Case No. 1)						
25years/ Female						
Final Diagnosis**: Unicystic Ameloblastoma**						
Diagnostic Method	**Lateral Extent (Score)**	**Bucco-Lingual Extent (Score)**	**Superio-Inferior Extent (Score)**	**Contents (Score)**	**Soft Tissue Involvement (Score)**	**Total Score**
1. OPG	1st premolar to mesial root of 3rd molar (3)	?Perforation of cortical plate (1)	0.5 cm from alveolar crest extending till lower border of mandible with expansion (2)	Multi loculer appearance (2)	Not accessible (0)	8
2. Conv.CT Scan	1st premolar to distal 3rd molar (3)	Bony expansion of buccal and lingual cortical plate with perforation over buccal plate (3) *	Extending from alveolar crest and expansion of lower border of mandible (3)	Soft tissue with areas of calcified compartment and air spaces (3)	Periosteum of buccal and lingual plate involved, with existing perforation involving masseteric musculature. (2)	14
3. 3D CT Scan	Canine to angle of mandible (4)	Bony expansion of bucco-lingual cortical plate with multiple perforation over both sides *(4)	'' same'' as above with perforation of lower border (4)	Multilocular appearance with air spaces (2)	Periosteum involvement bucco-lingually ,buccally involved through-out mesio-distal length with multiple perforations buccally (3)	17
4. Surgical Extent	Canine to distal to 3rd molar	Bony expansion of bucco-lingual cortical plate with multiple perforation over both sides	Alveolar crest to 2cm expansion off lower border with perforation	Soft tissue with areas of air spaces, multilocular	Periosteum involvement bucco-lingually ,buccally involved through-out mesio-distal length	

Similarly all remaining 19 cases were documented, tabulated and compared, using Friedman test.

RESULT

The study was conducted on 20 patient .12 patients were male and 8 were females.The age was between 30-62 years. The score as per the scoring criterion is mentioned in the table 3.

Table 3:- Scores obtained by differed imaging tool

Diagnostic Method	Lateral Extent (Score)	Bucco-Lingual Extent (Score)	Superio-Inferior Extent (Score)	Content of the lesion (Score)	Soft Tissue Involvement (Score)	Total Score
OPG	38(63.3%)	5 (8.3%)	31 (51.6%)	23 (38.3%)	0 (0%)	**97**
Conv.CT	41 (68.3%)	39 (65%)	33 (55%)	42 (70%)	45 (75%)	**200**
3D CT	49 (81.6%)	53 (88.3%)	40 (66.6%)	39 (65%)	41 (68.3%)	**222**

Further Friedman test was used to calculate the significance of the 3 imaging tools, in comparing the usefulness as per five determined criteria's (Chart 1).

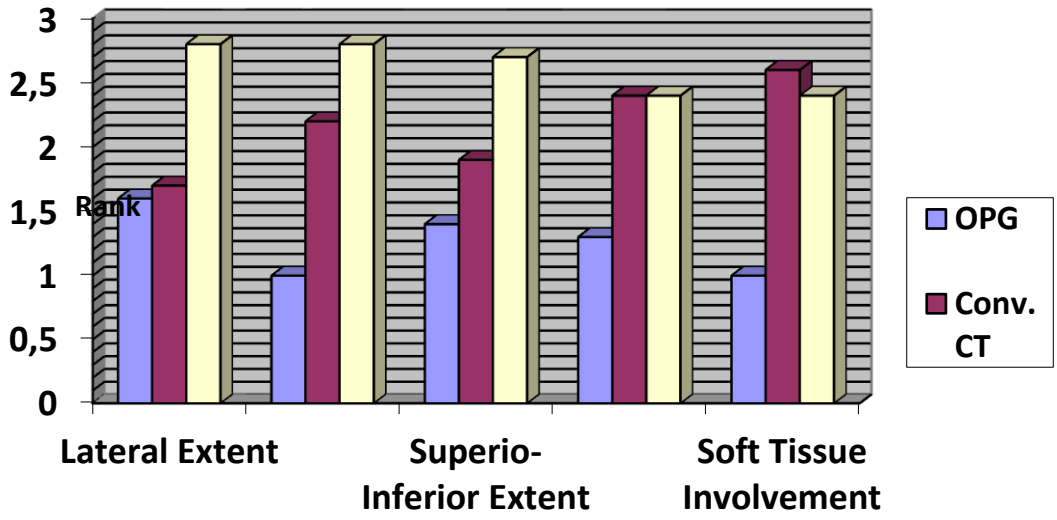

Chart 1Score obtained by different imaging tool

Friedman test verified the findings, that 3D CT scan ranked higher than other 2 tools for evaluating the dimensions of the pathology.

In case of content, both conv. CT and 3D CT ranked same, but for adjacent tissue involvement conv. CT ranked higher than the other 2 tools.

Pearson's correlation coefficient (p) was significant in all the 5 predetermined parameters on comparison with the 3 imaging tools and their comparison with actual existing pathology seen on surgical exploration.

Also, OPG shows a 32.33% of overall usefulness, as compared to 66% and 76.33% in conventional CT and 3D CT respectively.

DISCUSSION

Diagnosis remains by far the most essential aspect of successful treatment of disease. An accurate diagnosis in medicine may be the difference between life and death. In the field of oral and maxillofacial tumor surgery, planning remains the most essential part in assessment of tissue loss, operating time, defect reconstruction, disability, blood loss and preparation of other areas. A poorly planned surgery may end up with embarrassingly disastrous results[3.]

To achieve good planning a good imaging modality which adequately displays all dimensions of the lesion and the surrounding tissues is required. Many surgeons utilize many tools and a consensus is required as to which imaging choice would have maximum benefit. It was with this intension that this study was undertaken.

The benefit of CT far outweighs the extra cost. It may be suggested that a conventional radiograph may be used for screening purpose and then a spiral CT could be advised with 3D reconstruction when surgery is being planned.[5]

Further, the observed and tabulated data was verified by the Friedman test and significant (p) values were obtained in all the parameters. Our study also showed the higher ranking of 3D CT scan for evaluating the dimensions of pathology and higher ranking of conv. CT in case of adjacent tissue involved. In case of content both conv. CT and 3D CT hold equal importance. These findings were mostly in accordance with the emerging trend and observations of the surgeon[4,6]. multislice CT can obtain a great anatomic coverage during the scan[7]

SUMMARY

To summarize, the 3D CT appears to be the most useful tool in all aspects of surgical planning with regards to dimensions of pathology. With regard to contents of lesions and surrounding soft tissues the conventional CT is desirable. To evaluate tooth morphology and root resorption the OPG is a desirable adjuvant for a surgeon for planning and performing radical surgery. The 3D CT is valuable in giving him a clear picture of the surgery in the anatomical perceptions.

CONCLUSION

To conclude, when comparing the imaging modalities available presently “the 3D CT scan appears to be the most useful tool in the surgical planning” of pathological lesions with regards to evaluation of dimensions of lesion. The contents of the lesion and

surrounding soft tissue involvement were best evaluated on conventional CT. The Orthopantomograph's only advantage lay in the fact that it provided accurate tooth morphology and root resorption patterns. It can therefore be stated that the most useful among the studied imaging modalities in the diagnosis and surgical planning of pathological lessons is the 3D reconstruction of spiral CT Scanning and conventional CT scan. But the fact cannot be denied that OPG imaging not equally but contribute substantially in surgical planning

REFERENCES

1. Barbara Luka, Dirk Brechetelsbauer, Niels-ClaudiusGellrich, Matthias Konig: 2D and 3D CT Reconstructions of the facial skeleton: an unnecessary option or a diagnostic pearl?; Int J Oral Maxillofac Surg; 1995; 24; 76-83.

2. Tanrikulu, B. Erol; Comparison of CT with conventional radiography for midfacial fractures; DentoMaxillifac Radio; 2001; 30; 141-146.

3. Marder E.Alder, S. Thomas Deahl, Stephen R. Matteson; Clinical usefulness of 2D reformatted and 3D rendered computerized tomographic images; J Oral Maxillofacial Surgery; 1995; 53; 375-386.

4. Wu. C.T., M.R. Chen, S.L. Shih, F.Y. Huang, S.H Hou: Agenesis of the right lung diagnosed by three-dimensional reconstruction of helical chest CT; J British Radiology; 1996; 69; 1052-1054

5. Dr Gomathiponshankar Ilayappan , Prof. Dr Adaikkappan M. Multidetector Computed Tomographic Evaluation of Patterns of Facial Bone Fractures. Journal of Medical Science and Research center; 2018:06(10); 553-562.

6. Klenk G, Kovacs A. Do we need three dimensional computed tomography in maxillofacial surgery. J Craniofac surg 2004;15:842-850.

7. Hu H, He DH, Foley WD, et al. Four multidetector-row helical CT: image quality and volume coverage speed. Radiology 2000;215:55-62.

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