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Comparison of Panoramic Radiography and Computed Tomography in the Diagnosis of Jaw Lesions

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Abstract: ***Objective**: To compare the diagnostic accuracy of orthopantomography (OPG) and computed tomography (CT) against histopathology in patients with jaw lesions. **Methods**: In a prospective single-centre study, 50 consecutive patients with jaw lesions underwent OPG followed by CT within seven days. Histopathology, mapped to the WHO 2022 classification, served as the reference standard. **Results**: OPG detected 45 of 50 lesions (90%) and correctly identified the histopathological entity in 40 (80%), whereas CT detected all 50 (100%) and correctly identified the entity in 49 (98%). Four of the five OPG misses occurred in the maxilla, and all five were smaller than 40 mm. CT more clearly demonstrated cortical involvement, lesion density and multilocularity, and increased diagnostic confidence. **Conclusion**: CT is more accurate than OPG for identifying the type of jaw lesion, particularly in the maxilla and for aggressive lesions. OPG is a suitable first-line screening test, but CT should be obtained when a lesion is maxillary, multilocular, larger than 40 mm, or clinically atypical.*

Keywords: Orthopantomography, Computed Tomography, Jaw Lesions, Histopathology, Diagnostic Accuracy

1. Introduction

Jaw lesions span a broad spectrum, from inflammatory and developmental odontogenic cysts through benign neoplasms to rare malignancies, each requiring a distinct surgical approach. Radicular and dentigerous cysts dominate practice [1, 2], while ameloblastoma carries the greatest clinical impact owing to its locally aggressive behaviour and recurrence risk [3]. Orthopantomography remains the most widely used initial modality because of its low cost, low radiation dose and broad coverage, but its two-dimensional projection produces structural superimposition- especially in the anterior maxilla- and cannot reliably show cortical perforation, soft-tissue extension or three-dimensional morphology [4].

Computed tomography overcomes these limitations through thin-section multiplanar acquisition, three-dimensional reconstruction and density measurement in Hounsfield Units. Earlier work has shown that CT yields higher diagnostic accuracy than panoramic radiography for jaw lesions [5], yet many comparisons rely on radiology-to-radiology agreement rather than histopathology, and contemporary Indian data using the WHO 2022 framework [6] remain limited. We therefore prospectively compared OPG and CT against histopathology in 50 consecutive patients, following STARD 2015 reporting standards [7].

2. Materials and Methods

This prospective observational study was conducted over 18 months at the Department of Radiodiagnosis, SMIMER, Surat, and was approved by the Institutional Ethics Committee. Consecutive patients of any age with jaw-related complaints who were willing to undergo both examinations were enrolled. Pregnancy, prior surgery on the index lesion, and contrast hypersensitivity where enhancement was indicated were exclusion criteria.

Digital panoramic radiography (ACTEON X-Mind Prime) and multidetector CT (GE Revolution Maxima) were performed a mean of 3.5 days apart. Each study was assessed with a structured proforma recording lesion site, shape, margins, density, locularity, cortical status, largest dimension, a ranked differential diagnosis and a five-point confidence score. Both resident authors read the images independently, blinded to histopathology and to each other, with disagreements resolved by consensus. Biopsy with routine staining, supplemented by immunohistochemistry where indicated, provided the reference standard, mapped to the WHO 2022 fifth-edition classification [6]. A standard sensitivity formula required 46 patients [8]; 50 were enrolled. Diagnostic accuracy was expressed as sensitivity against histopathology, with proportions and measurements summarised descriptively; $p < 0.05$ was considered significant.

3. Results

The cohort had a mean age of 41.3 years with a slight female predominance (54%) and a mandible-to-maxilla ratio of 29:21. Histopathology confirmed a cyst-dominant case mix: radicular cyst (46%), dentigerous cyst (22%), ameloblastoma (14%) and odontogenic keratocyst (10%), together with two central giant-cell granulomas and two squamous-cell carcinomas. All seven ameloblastomas and four of five keratocysts were mandibular, whereas both carcinomas and both giant-cell granulomas were maxillary- a distribution consistent with recent WHO 2022 series [1, 2].

OPG detected 45 of 50 lesions (90%) and correctly identified the entity in 40 (80%), while CT detected all 50 (100%) and correctly identified the entity in 49 (98%); this difference was statistically significant (Figure 1). In every case where the two modalities disagreed, CT gave the correct answer and OPG did not. CT's single error- a giant-cell granuloma reported as a radicular cyst- was also misread on OPG, indicating a difficult entity rather than a limitation of CT.

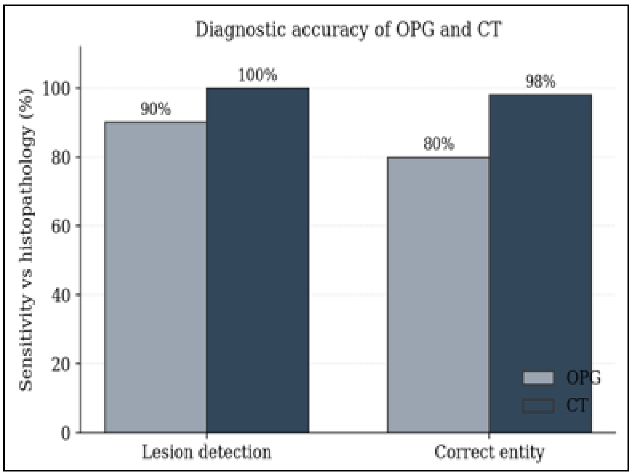

Figure 1: Lesion detection and correct-entity identification by OPG and CT, expressed as sensitivity against histopathology (n = 50).

Four of the five OPG misses were maxillary, giving a sensitivity of 81.0% in the maxilla against 96.6% in the mandible. All five missed lesions were smaller than 40 mm, and OPG sensitivity improved with lesion size (67% below 20 mm, 83% at 20–40 mm and 87% above 40 mm). Diagnostic confidence was higher with CT than with OPG, and CT changed the working diagnosis in about three-quarters of cases, most often for small or maxillary lesions.

Density measurements differed between lesion types: ameloblastoma showed the highest Hounsfield Units, reflecting solid tumour content, while dentigerous cyst showed the lowest, consistent with a fluid content (Figure 2). Aggressive lesions (ameloblastoma and odontogenic keratocyst) were larger than the benign cysts. Ameloblastoma was typically multilocular with frequent cortical perforation, keratocysts showed intermediate features, and the simple cysts were uniformly unilocular. OPG slightly underestimated lesion size compared with CT (by about 2 mm on average).

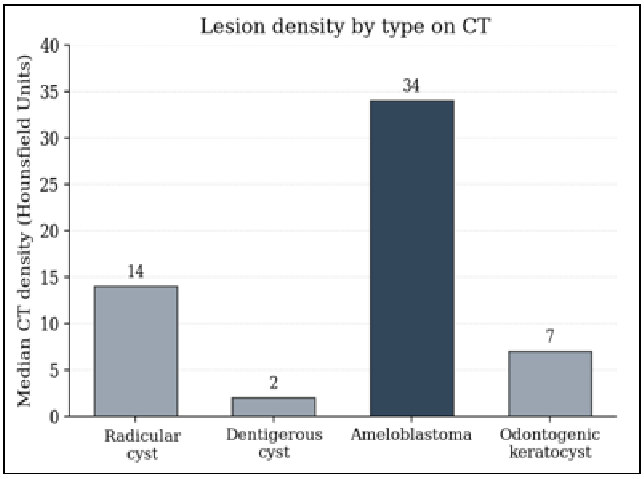

Figure 2: Median CT density (Hounsfield Units) for the four main lesion types, showing the higher density of ameloblastoma and the low density of the cysts.

4. Discussion

CT correctly identified the lesion type in 98% of cases compared with 80% for OPG, in keeping with earlier reports [5] but with a larger margin. The cohort's age, sex distribution and case mix closely match recent Indian and international series [9, 10], and the entity– jaw pattern- all ameloblastomas mandibular, both malignancies and giant-cell lesions maxillary- agrees with published odontogenic-tumour [11] and rare non-odontogenic-lesion [12] distributions, supporting the representativeness of the sample.

The concentration of OPG misses in the maxilla is readily explained: overlap of the cervical spine and zygomatic processes, thinner alveolar cortex and the air-containing maxillary sinus all reduce contrast on panoramic images [4, 5]. CT resolves these problems and allows lesion density, size and locularity to be assessed directly; comparable CT criteria have previously been used to distinguish common jaw lesions [13], and the superiority of cross-sectional imaging over plain radiography has been confirmed in large series [14]. The density and morphological patterns we observed match published descriptions [4] and the features associated with aggressive behaviour and recurrence [3], and support a simple two-step approach: OPG as the initial test for any jaw complaint, followed by CT when the lesion is maxillary, multilocular or shows cortical perforation, exceeds 40 mm, or when suspicion remains despite a normal OPG.

Strengths of the study include a histopathological reference standard for every case, prospective consecutive enrollment within a defined seven-day window, WHO 2022 mapping [6] and STARD 2015 reporting [7]. Limitations include single-centre enrollment of 50 patients, the absence of a disease-free comparison group (so specificity and predictive values could not be estimated), the lack of recorded radiation dose despite the importance of keeping doses as low as reasonably achievable [15], and small numbers of the rarer lesions. Larger multi-centre studies, systematic dose recording, and attention to the evolving classification of the odontogenic keratocyst as a locally aggressive lesion [16] are appropriate next steps.

5. Conclusion

In this prospective study of 50 patients with histopathologically confirmed jaw lesions, CT identified the lesion type correctly in 98% of cases compared with 80% for OPG. Most OPG errors involved small or maxillary lesions. OPG remains a reasonable first-line screening test for mandibular lesions, but CT should be obtained whenever a lesion is maxillary, multilocular, larger than 40 mm, or clinically atypical.

References

[1] Kokubun K, Akashi Y, Nakajima K, Yamamoto K, Watanabe A, Katakura A, et al. Epidemiologic and clinicopathologic features of 19,352 jaw cysts: a single-center retrospective study. BMC Oral Health. 2026;26(1). https://doi.org/10.1186/s12903-026-07776-y

[2] Du C, Wang Z, Lan D, Zhu R, Wang D, Wang H, et al. Clinical analysis of 1,038 cases of odontogenic jawbone cysts. BMC Oral Health. 2024;24(1):1387. https://doi.org/10.1186/s12903-024-05167-9

[3] Inthong P, Upalananda W, Saepoo J. Factors Associated with Recurrence of Ameloblastoma: A Scoping Review. Head Neck Pathol. 2024;18(1):82. https://doi.org/10.1007/s12105-024-01686-7

[4] Kitisubkanchana J, Reduwan NH, Poomsawat S, Pornprasertsuk-Damrongsri S, Wongchuensoontorn C. Odontogenic keratocyst and ameloblastoma: radiographic evaluation. Oral Radiol. 2021;37(1):55–65. https://doi.org/10.1007/s11282-020-00425-2

[5] Mao WY, Lei J, Lim LZ, Gao Y, Tyndall DA, Fu K. Comparison of radiographical characteristics and diagnostic accuracy of intraosseous jaw lesions on panoramic radiographs and CBCT. Dentomaxillofac Radiol. 2021;50(2):20200165. https://doi.org/10.1259/dmfr.20200165

[6] Soluk-Tekkesin M, Wright JM. The World Health Organization Classification of Odontogenic Lesions: A Summary of the Changes of the 2022 (5th) Edition. Turk Patoloji Derg. 2022;38(2):168–84. https://doi.org/10.5146/tjpath.2022.01573

[7] Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig L, et al. STARD 2015: an updated list of essential items for reporting diagnostic accuracy studies. BMJ. 2015;351:h5527. https://doi.org/10.1136/bmj.h5527

[8] Buderer NM. Statistical methodology: I. Incorporating the prevalence of disease into the sample size calculation for sensitivity and specificity. Acad Emerg Med. 1996;3(9):895–900. https://doi.org/10.1111/j.1553-2712.1996.tb03538.x

[9] Khandelwal P, Rai AB, Bulgannawar B, Gupta H, Khan Z, Hajira N. Prevalence, Characteristics and Distribution of Odontogenic Cysts amongst the Indian Subpopulation of Southern Rajasthan: A 5-year Retrospective Study of 218 Cysts. Niger Postgrad Med J. 2024;31(3):255–62. https://doi.org/10.4103/npmj.npmj_39_24

[10] Bhat A, Mitra S, Chandrashekar C, Solomon M, Kulkarni S. Odontogenic cysts and odontogenic tumors in a large rural area from India. A 10-year reflection. Med Pharm Rep. 2019;92(4):408–12. https://doi.org/10.15386/mpr-1295

[11] Rubini C, Mascitti M, Santarelli A, Tempesta A, Limongelli L, Favia G, et al. Odontogenic tumors: a retrospective clinicopathological study from two Italian centers. Pathologica. 2017;109(1):35–46.

[12] Akkoyunlu M, Bulgurcu E, Delilbaşı C, Sabir N. Radiological features of rare non-odontogenic lesions of the jaws. Curr Med Imaging. 2024;20:e010923220660. https://doi.org/10.2174/1573405620666230901102904

[13] Sueyoshi T, Sameshima J, Kaneko N, Chikui T, Chen H, Yokomizo S, et al. Comparison of computed tomographic findings for radiolucent lesions of the mandibular ameloblastoma, odontogenic keratocyst, dentigerous cyst, and simple bone cyst. J Dent Sci. 2025;20(1):605–12. https://doi.org/10.1016/j.jds.2024.04.013

[14] De Campos RS, Barbosa GG, Pela MM, Soares AB, Moreira DD, Do Carmo Nascimento M, et al. Radiographic features of radiolucent odontogenic lesions associated with impacted teeth: a cross-sectional study of 454 cases. Oral Maxillofac Surg. 2025;29(1):176. https://doi.org/10.1007/s10006-025-01454-z

[15] Kaasalainen T, Ekholm M, Siiskonen T, Kortesniemi M. Dental cone beam CT: An updated review. Phys Med. 2021; 88: 193–217. https://doi.org/10.1016/j.ejmp.2021.07.007

[16] Valdivia ADCM, Ramos-Ibarra ML, Franco-Barrera MJ, Arias-Ruiz LF, García-Cruz JM, Torres-Bugarín O. What is Currently Known about Odontogenic Keratocysts? Oral Health Prev Dent. 2022; 20: 321–30. https://doi.org/10.3290/j.ohpd.b3240829