Universidad Europea

# GRADUATION PROJECT

## Degree in Dentistry

# CHAT GPT IN THE DIAGNOSIS OF TUMOUR LESIONS IN THE MAXILLA

**Madrid, academic year 2025/2026**

Identification number: 200

## RESUMEN

**Introducción:** Las lesiones tumorales del maxilar representan un grupo heterogéneo de patologías, odontogénicas, óseas, fibro-óseas y epiteliales cuyo diagnóstico temprano es determinante para el pronóstico del paciente. La integración de la inteligencia artificial (IA) en la práctica clínica odontológica, y en particular de modelos de lenguaje como ChatGPT, abre nuevas posibilidades de apoyo diagnóstico, aunque su adopción real permanece limitada y poco estudiada; **Objetivos:** Evaluar cómo ChatGPT puede asistir a profesionales y estudiantes de odontología en la interpretación de información diagnóstica de tumores maxilares; comparar su razonamiento con enfoques diagnósticos convencionales; y analizar las percepciones y actitudes de los profesionales sanitarios hacia su uso clínico; **Metodología:** Se diseñó un estudio de métodos mixtos con tres componentes: (1) una revisión sistemática de la literatura en PubMed/MEDLINE (2019–2025, 7 artículos incluidos) sobre percepciones de la IA en odontología; (2) un cuestionario estructurado de 20 preguntas, validado por la comisién ética (OD.078/2526) y see distribuyeron a 111 profesionales y estudiantes de odontología, de los cuales se seleccionaron 100; y (3) una simulación clínica en la que ChatGPT (GPT-5.1) analizó vignetas clínicas estandarizadas de lesiones maxilares, evaluado independientemente por Los resultados de esos casos clínicos y verificar la precisión de ChatGPT; **Resultados:** El 85 % de los encuestados nunca ha utilizado IA en un contexto diagnóstico real, pese a que el 54 % tiene conocimiento de estas herramientas. La confianza en los sistemas de IA fue moderada (50 % puntuó 3/5). El 72 % considera imprescindible la validación local antes de su integración clínica, y el 51 % la supeditaría a la aprobación de una autoridad sanitaria oficial. La principal preocupación fue la responsabilidad legal en caso de error (47 %). El 59 % prevé un papel de apoyo, no sustitutivo de la IA en el diagnóstico. En la simulación clínica, ChatGPT demostró capacidad para generar diagnósticos diferenciales razonados, aunque con limitaciones en la especificidad; **Conclusiones:** ChatGPT muestra potencial como herramienta de apoyo al diagnóstico de tumores maxilares, especialmente en la interpretación radiográfica y la generación de diagnósticos diferenciales. Sin embargo, su integración clínica exige validación local, marcos regulatorios claros y formación específica. El modelo de adopción preferido por los profesionales es el adjunto: IA que asiste al clínico, nunca que lo sustituye.



**PALABRAS CLAVE**

Odontologia, ChatGPT; inteligencia artificial; diagnóstico odontológico; tumores maxilares.

## ABSTRACT

**Introduction:** Maxillary tumour lesions constitute a heterogeneous group of pathologies odontogenic, osseous, fibro-osseous, and epithelial in which early diagnosis is a key determinant of prognosis. The integration of artificial intelligence (AI) into dental clinical practice, particularly large language models such as ChatGPT, opens new possibilities for diagnostic support; however, real-world adoption remains limited and poorly characterised; **Objectives:** To assess how ChatGPT can assist dental professionals and students in interpreting diagnostic information related to maxillary tumours; to compare its diagnostic reasoning with conventional approaches; and to evaluate the perceptions and attitudes of oral healthcare professionals towards its clinical use; **Methods:** A mixed-methods study was designed comprising three components: (1) a systematic literature review in PubMed/MEDLINE (2019–2025, 7 articles included) on clinician perceptions of AI in dentistry; (2) a structured 20-item questionnaire, ethics-approved (OD.078/2526) and distributed to 111 dental professionals and students which a 100 were selected; and (3) a clinical simulation in which ChatGPT (GPT-5.1) analysed standardised clinical vignettes of maxillary lesions, independently evaluated by The results of thoses clinical cases and verify the accuracy of ChatGPT; **Results:** Eighty-five percent of respondents had never used AI in a real diagnostic context, despite 54 % being aware of such tools. Confidence in AI systems was moderate (50 % scored 3/5). Seventy-two percent considered local validation essential prior to clinical integration, and 51 % would only adopt AI following formal approval by a health authority. Legal liability in the event of error was the primary concern (47 %). Fifty-nine percent envisaged a supportive rather than autonomous role for AI. In the clinical simulation, ChatGPT demonstrated the ability to generate reasoned differential diagnoses, albeit with limitations in specificity; **Conclusions:** ChatGPT shows potential as a decision-support tool for maxillary tumour diagnosis, particularly for radiographic interpretation and differential diagnosis generation. Clinical integration, however, requires local validation, clear regulatory frameworks, and specific professional training. The adoption model preferred by practitioners is adjunctive: AI that assists the clinician, never one that replaces them.

**KEYWORDS**

Dentistry, ChatGPT; artificial intelligence; dental diagnosis; maxillary tumours

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# 1. INTRODUCTION

## 1.1. Concept of tumoral lesions

Tumour lesions refer to abnormal growths that arise when cells begin to multiply in an unregulated way. Under normal conditions, cells divide, mature, and die in a controlled cycle through tightly regulated processes such as mitosis (division of somatic cells) and in reproductive tissues as meiosis. These processes are monitored by a complex network of regulatory mechanisms, including DNA-repair systems, cell-cycle checkpoints, tumour suppressor genes, and programmed cell death (apoptosis) (1). Every day, these systems correct genetic errors, eliminate damaged cells, and ensure that cell division occurs only when appropriate (2). One of the key regulators in this network is the tumour suppressor gene TP53, which encodes the p53 protein. p53 is known as the “guardian of the genome” because it responds to various cellular stresses such as DNA damage by activating protective mechanisms that maintain genomic stability (1). When damage is detected during the cell cycle, p53 induces cell-cycle arrest to allow DNA repair, or triggers apoptosis when the damage is beyond repair (3). Additionally, p53 helps prevent the propagation of cells with chromosomal abnormalities. After mitotic errors or whole-genome doubling, p53 suppresses the survival of abnormal cells, preventing them from progressing through the division cycle (4). However, when TP53 is mutated or inactivated, these protective mechanisms fail. Despite DNA damage or abnormal mitosis, the cell continues to divide unchecked,

Accumulating mutations and promoting uncontrolled proliferation ultimately increasing the risk of forming tumoral lesions (2).

## 1.2. Classification of tumoral lesions

A tumor, also referred to as a neoplasm, is defined as an abnormal and autonomous proliferation of cells that persists even after the cessation of the initiating stimulus, resulting in the formation of a mass of tissue with altered growth regulation (6). Tumors represent a broad and

heterogeneous group of lesions, whose classification is essential for understanding their biological behavior, prognosis, and therapeutic management (5).

The first and most fundamental approach to tumour classification is based on biological behavior, which distinguishes lesions according to their capacity for growth, invasion, and metastasis (6). Benign tumors are characterized by slow growth, well-defined borders, and an absence of metastatic potential, although they may still cause local functional or esthetic problems depending on their size and location (6). In contrast, malignant tumors exhibit invasive growth, cellular atypia, and the ability to metastasize to distant sites, representing a major cause of morbidity and mortality worldwide (5). Between these two extremes, a group of intermediate or locally aggressive tumors exists; these lesions may appear histologically benign but demonstrate infiltrative behavior and a high recurrence rate, a concept particularly relevant in head and neck pathology (5).

Beyond biological behavior, tumors are further classified according to their tissue or cell of origin, which constitutes the cornerstone of modern oncologic pathology (6). Epithelial tumors arise from surface epithelium or glandular structures and include benign entities such as papillomas and adenomas, as well as malignant forms collectively known as carcinomas, with squamous cell carcinoma being the most common epithelial malignancy in the head and neck region (5). Mesenchymal tumors originate from connective tissues such as bone, cartilage, muscle, and adipose tissue; benign examples include fibromas, lipomas, and osteomas, while their malignant counterparts are classified as sarcomas, such as osteosarcoma and chondrosarcoma (6).

A separate category is formed by hematolymphoid neoplasms, including lymphomas and plasma cell tumors, which may primarily or secondarily involve bone and soft tissues of the craniofacial region (5). Neuroectodermal tumors, derived from neural crest or nerve sheath cells, include lesions such as neurofibromas and melanocytic tumors, which display distinct biological behavior despite sometimes limited local extension (6). Finally, mixed tumors, composed of more than one tissue type, such as pleomorphic adenoma of the salivary glands, illustrate the complexity of tumour histogenesis (5).

In addition to origin and behavior, tumors may also be described according to morphological and structural patterns, which can assist in diagnosis and clinical interpretation (5). Some neoplasms present predominantly as solid masses, while others show cystic architecture, a feature particularly relevant in lesions derived from odontogenic tissues (5). Bone-forming

tumors represent a distinct subgroup characterized by the production of osteoid or mineralized tissue, whereas fibro-osseous lesions constitute a unique category in which normal bone is replaced by fibrous tissue containing varying degrees of mineralization, and although often benign, they may mimic true neoplasms clinically and radiographically (5,7).

Within the craniofacial skeleton, and particularly in the maxilla, tumoral lesions follow the same fundamental principles of classification described above; however, their presentation is strongly influenced by anatomical, embryological, and functional factors specific to the maxillofacial region (5). The maxilla is unique in that it may harbor tumors of odontogenic origin, lesions related to bone and fibro-osseous metabolism, as well as epithelial malignancies arising from the oral mucosa or maxillary sinus, making a region-specific classification necessary for accurate diagnosis and management (8).

For this reason, maxillary tumors are most effectively classified by applying the general oncologic framework biological behavior and tissue of origin while restricting the entities to those known to occur in the maxillofacial bones and adjacent structures, as proposed in the World Health Organization classification of head and neck tumors (5).

| Category | Tumour group | Example | Keynotes (maxilla-specific) |
|---|---|---|---|
| Odontogenic tumor | Benign odontogenic tumor | Ameloblastoma, odontoma, odontogenic myxom | Exclusive to jaws; often locally aggressive |
| | Malignant odontogenic tumor | Ameloblastic carcinoma | Rare but aggressive |
| Bone and cartilage tumors | Benign bone tumor | Osteoma, chondrom | Slow growing, often incidental |
| | Malignant bone tumors | Osteosarcoma, chondrosarcom | Pain, rapid growth, ill-defined margins |
| Fibro-osseous lesions | Benign fibro-osseous lesions | Fibrous dysplasia, ossifying fibroma | Tumor-like behavior; common in maxilla |
| Giant cell lesion | Giant cell–rich lesion | Central giant cell granulom | Locally aggressive, young patients |
| Soft tissue tumors | Benign soft tissue tumor | Hemangioma, neurofibrom | May cause expansion or bleeding |
| | Malignant soft tissue tumors | Sarcoma | Rare in maxilla |
| Epithelial malignancie | Carcinomas | Squamous cell carcinom | Often invade maxilla from mucosa or sinu |
| Hematolymphoid tumors | Lymphoid & plasma cell tumors | Lymphoma, plasmacytom | Can mimic dental infection |
| Metastatic tumor | Secondary tumors | Breast, lung, kidne | Rare but aggressive |

**Figure 1:** Chart of tumour lesions

### 1.3. History of tumoral diagnosis

In ancient Egypt, tumours were first described as abnormal swellings or masses, and later, Hippocrates used the term karkinos (“crab”) to describe cancer, referring to its spreading, claw-like appearance. At that time, diagnostic methods were extremely limited, relying mainly on visual observation and palpation, as microscopic tools did not yet exist(9).

It was only in the 19th century that the invention of the microscope marked the beginning of a new era in tumour diagnosis and understanding. This period saw the birth of histopathology, the study of tissues under the microscope. With this advancement, Rudolf Virchow (1821–1902) introduced the concept of cellular pathology, demonstrating that tumours originate from normal cells that undergo abnormal development (10)(11)(12). This discovery established diagnosis as a discipline based on morphological features, focusing on cellular detail and tissue architecture.

### 1.4. Current methods of tumoral diagnosis

During the 20th and 21st centuries, further technological innovations including radiology (X-rays, CT, and MRI), biopsy, immunohistochemistry, and electron microscopy made tumour diagnosis more precise. The introduction of molecular biology enabled the identification of gene mutations, chromosomal translocations, and molecular markers, which refined the classification of tumour types(12)(9)(6). Today, we are witnessing the rise of AI-assisted imaging and radiomics, tools that can analyse patterns and predict tumour behaviour(15). Altogether, these technological advancements have greatly enhanced the accuracy and depth of tumour diagnosis.

In current diagnostic practice, three major aspects are considered essential: clinical characteristics, radiographic features, and histopathological findings.

### 1.5. Future generation of tumoral diagnosis (AI)

Now that we have briefly reviewed the historical background of tumour diagnosis, we can focus on tumours of the maxilla. The maxilla, or upper jaw, presents unique diagnostic challenges because of its complex anatomy, its proximity to vital structures, and the wide range of

odontogenic and non-odontogenic tumours that can develop there. Since the mid-20th century, the classification of odontogenic tumours proposed by Robert J. Gorlin and colleagues (1940–1960) has provided an essential framework, grouping tumours based on their tissue of origin and histological characteristics (5).

### 1.5.1. Introduction to AI

Artificial intelligence (AI) refers to the development of computer systems capable of performing tasks that traditionally require human intelligence, such as learning, reasoning, pattern recognition, and decision-making (13). In recent years, AI has emerged as a transformative force in healthcare, driven by the increasing availability of large datasets, advances in computational power, and the development of sophisticated machine learning algorithms (14).

In clinical practice, AI systems are primarily designed to augment human decision-making rather than replace clinicians, enabling faster, more accurate, and more personalized medical care (15). By analyzing vast amounts of clinical, radiological, and biological data, AI can identify complex patterns that may not be immediately apparent to human observers, thereby improving diagnostic accuracy and consistency (14).One of the most prominent applications of AI in healthcare is medical diagnosis, particularly in imaging-based disciplines such as radiology, pathology, and oncology, where AI algorithms have demonstrated performance comparable to or exceeding that of human experts in specific tasks (15). Beyond diagnosis, AI also plays an important role in treatment planning and personalized medicine, allowing therapies to be tailored to individual patient characteristics and predicted responses (14).

AI technologies further contribute to clinical workflow optimization by supporting decision-making, automating routine tasks, and reducing administrative burden, which may help mitigate clinician burnout and improve patient–provider interactions (16). Natural language processing systems, for example, can assist in clinical documentation by converting spoken or written information into structured medical records (16).Despite its significant potential, the integration of AI into healthcare raises important ethical, legal, and practical challenges. Concerns related to data privacy, algorithmic bias, transparency, and accountability must be carefully addressed to ensure patient safety and equity in care delivery (17). The World Health Organization

emphasizes that AI systems should be developed and implemented within a robust ethical framework, with continuous human oversight and clear regulatory standards (17).

Overall, artificial intelligence represents a powerful tool capable of enhancing clinical performance and healthcare system efficiency when applied responsibly. Its successful adoption depends on interdisciplinary collaboration, high-quality data, and the continued central role of human judgment in medical decision-making (14,15).

### 1.5.2. Clinical characteristics

The clinical characteristics of a tumour are of great importance because they provide the first clues that guide the diagnostic process. Clinical examination allows the clinician to evaluate the location, size, shape, color, consistency, and growth rate of the lesion, as well as the presence of pain, bleeding, or functional disturbance. These features help determine whether the tumour behaves in a benign or malignant manner even before radiographic or histological studies are performed. For instance, a benign tumour often presents as a slow-growing, well-circumscribed, and painless swelling, whereas a malignant lesion may appear as a rapidly enlarging mass, sometimes associated with pain, ulceration or paresthesia due to nerve involvement. In the maxillofacial region, clinical evaluation is particularly essential because of the anatomical complexity and proximity of vital structures such as the nasal cavity, maxillary sinus and orbit. Symptoms like nasal obstruction, tooth mobility, facial asymmetry, or sinus expansion can provide valuable diagnostic indicators. Therefore, clinical characteristics form the foundation of tumour diagnosis, allowing the clinician to establish an initial impression and guide the choice of further investigations such as imaging and biopsy.

### 1.5.3. Histological study

The Histological study is one of the most important aspects of examination, to distinguish between the two fundamental natures of tumors: benign and malignant. These terms are highly specific and play a crucial role in determining the appropriate approach to treatment. A benign tumour is a non-cancerous growth that remains localized, generally grows slowly, and does not

invade surrounding tissues or spread to distant sites meaning it shows no metastasis. In contrast, a malignant tumour is cancerous, characterized by rapid growth, invasion of adjacent tissues, and the potential to metastasize to other parts of the body.The differentiation between these two types is based on several microscopic features, including cellular morphology (the shape, size, and arrangement of cells), the tissue architecture, and the nature of the stroma, which represents the supporting connective tissue of the tumor. In the case of the maxilla, histological analysis also provides insight into the origin of the tumor. The presence of structures such as enamel, dentin, calcifications, or keratin formation can indicate odontogenic origin.

The study allows us to look closely at the microscopic structure of a tumor. It helps identify the type of cells involved, their level of differentiation, and how the tumour interacts with the surrounding tissue. Under the microscope, a benign tumour usually shows well-differentiated cells that closely resemble the normal tissue of origin, and it tends to have a well-defined capsule that limits its growth. In contrast, a malignant tumour often shows poorly differentiated or atypical cells with abnormal shapes and sizes, high mitotic activity, and loss of normal tissue organization. The presence of invasion into adjacent structures, areas of necrosis, or a strong stromal and vascular reaction are also common features of malignancy (6)(5). In short, histology provides precise information about the cellular nature, aggressiveness, and biological behavior of the tumor, making it essential for a definitive diagnosis.

### 1.5.4. Radiographic studies

Radiographic studies**,** on the other hand, offer a broader structural view of how the tumour affects the surrounding bone and anatomical features. They allow us to observe the lesion's shape, borders, internal structure, and effect on neighboring tissues. A benign lesion generally shows smooth, well-defined borders and causes expansion of bone without breaking through it, reflecting its slow and localized growth. A malignant lesion, however, tends to have irregular or poorly defined margins and may appear to destroy bone in an invasive "moth-eaten" pattern. Radiographs can also reveal root resorption, displacement of teeth, or cortical bone perforation, which help evaluate the tumor's extent (5). Radiographic examination therefore provides an overall picture of the tumor's behavior, growth rate, and impact on bone, complementing the microscopic information obtained from histology (6).

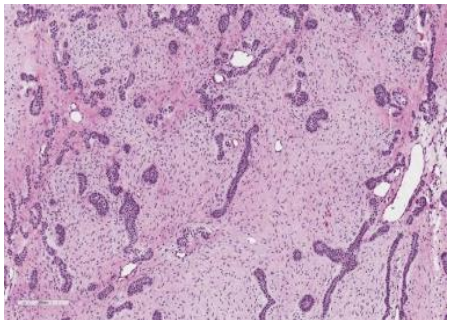


**Figure 1:** Microscopic Image of an Odontogenic Epithelial (25).

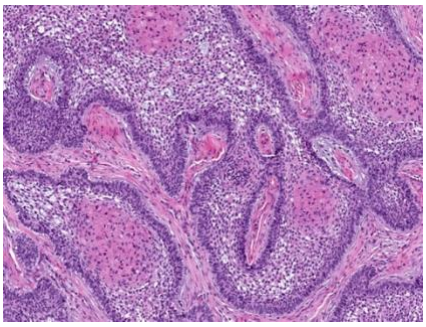


**Figure 2:** Microscopic image of Ameloblastoma (26).

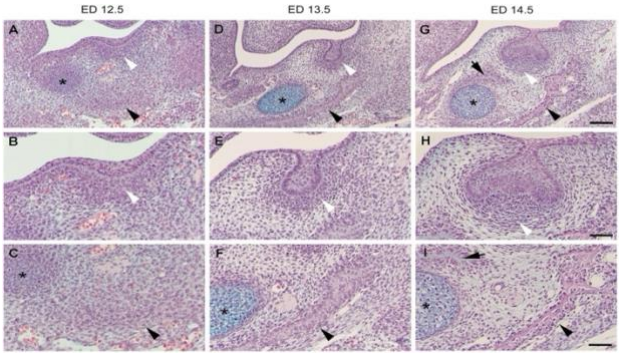



**Figure 3:** Microscopic Image of and Odontogenic Mesenchyme (27).

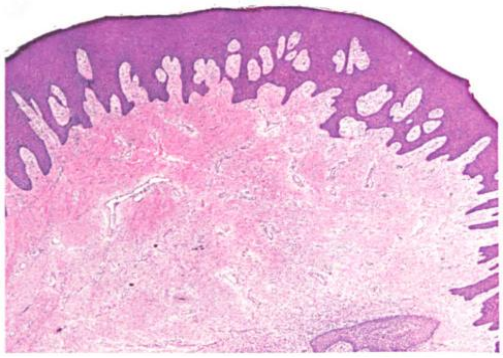


**Figure 4:** Microscopic Image of an Odontogenic Fibroma (28).

### 1.6. Justification

The rapid evolution of artificial intelligence (AI) is transforming many aspects of healthcare, including medical and dental diagnostics. Among the most recent tools, large language models like ChatGPT have demonstrated a remarkable ability to analyze complex information, synthesize scientific knowledge, and support clinical reasoning. Simultaneously, the integration of AI systems into diagnostic processes is becoming widespread in fields such as radiology, dermatology, and oncology. However, in oral and maxillofacial diagnostics and particularly for the detection of oral and maxillary tumors the integration of these technologies remains relatively unexplored.

This topic is more relevant given that early diagnosis is one of the most crucial factors in the prognosis of oral cavity cancers and maxillary tumors. Diseases such as oral squamous cell carcinoma often present with subtle or nonspecific clinical signs that may be overlooked during routine examinations. A delayed diagnosis can lead to disease progression, more aggressive treatments, and a significant reduction in survival rates. In this context, AI tools have the potential to assist clinicians by improving diagnostic accuracy, highlighting suspicious patterns, and facilitating the interpretation of clinical and radiological data. Furthermore, AI systems such as ChatGPT could serve as decision support tools, enabling healthcare professionals to quickly access and synthesize a vast body of scientific literature. This capability could prove particularly valuable for dentists, who are often the first to observe suspicious oral lesions but do not always have immediate access to specialist expertise. By providing structured information, differential diagnoses, and evidence-based data, AI could contribute to earlier detection and faster referral to specialists.

Another crucial aspect of this research lies in the perception and acceptance of AI by healthcare professionals. While technological tools can offer considerable potential benefits, their actual impact largely depends on how clinicians perceive their reliability, usefulness, and ethical implications. Understanding these perceptions is essential to ensuring the safe and effective integration of AI into clinical practice. Therefore, studying how dentists and physicians perceive tools such as ChatGPT is an important step in identifying barriers, expectations, and opportunities for future implementation.Beyond improving diagnostic processes, AI could ultimately help reduce diagnostic delays, improve patient care, and potentially save lives. By helping clinicians recognize early signs of disease and facilitating access to relevant knowledge, AI technologies can help fill expertise gaps, particularly in settings where specialist care is limited. In dentistry, where routine examinations offer a unique opportunity for the early detection of oral pathologies, the integration of AI-assisted diagnostic support could play a significant role in the future of preventive and precision medicine.

For these reasons, it is both timely and necessary to explore the scientific literature on healthcare professionals' perceptions of AI and conversational voice assistants (ChatGPT) in medical and dental diagnosis, particularly in the context of oral and maxillofacial tumors. Understanding these perspectives will help determine how these technologies can be responsibly integrated into clinical

practice, ensuring they complement clinical expertise rather than replace it, while simultaneously improving patient care.

# 2. OBJECTIVES:

## 2.1. Primary Objective:

1-To assess how ChatGPT can assist dental and medical practitioners or students in interpreting diagnostic information related to maxillary tumors (e.g., identifying key features, generating differential diagnoses, explaining histological terms).

## 2.2. Secondaries Objectives:

2- To compare ChatGPT's diagnostic reasoning with conventional diagnostic approaches, evaluating its accuracy, clarity, and limitations in relation to established literature and expert judgment.

3- To design and test a diagnostic simulation where ChatGPT is used to analyze clinical or radiographic case scenarios of maxillary tumors and compare its responses with those of trained clinicians.

# 3. MATERIALS AND METHODS

This study was designed to explore two complementary aspects:

- How dental professionals and students perceive the use of ChatGPT in diagnosing maxillary tumors?

- How ChatGPT actually performs when confronted with standardized clinical scenarios involving maxillary lesions?

To achieve this, the study relied on three components:

- A review of scientific articles examining how healthcare professionals perceive the use of ChatGPT and artificial intelligence in medical and dental diagnosis.
- A questionnaire composed of 20 targeted questions addressing knowledge, perceptions, and attitudes toward the use of ChatGPT in diagnostic contexts. Accepted by the Ethnic commission, of the department number: OD.078/2526
- A diagnostic simulation using ChatGPT, in which the model was asked to analyze standardized clinical scenarios involving maxillary lesions.

### 3.1. Overall Study Design

We adopted a mixed-methods approach combining literature analysis, quantitative data collection, and qualitative evaluation.

First, a review of relevant scientific literature was conducted to identify existing research on the use of ChatGPT and similar artificial intelligence tools in healthcare diagnosis, as well as the perceptions of healthcare professionals regarding these technologies. This step provided a theoretical framework and helped contextualize the study.

The quantitative component consisted of a structured questionnaire distributed to a wide range of dental professionals and students in order to assess their level of familiarity with ChatGPT, their perceived usefulness of the tool, and their concerns regarding its use in diagnostic practice.

The qualitative component involved analyzing ChatGPT's responses to several carefully designed clinical case scenarios involving maxillary lesions. This simulation allowed us to observe how the model interprets clinical information and formulates diagnostic hypotheses.

This combination allowed us to evaluate both human perspectives on artificial intelligence in dentistry and the actual diagnostic behavior of the tool.

### 3.2. Research Study

The methodology used for the identification and selection of relevant scientific articles is described below.

Database: PubMed/Medline

Search keywords: "dentistry", "artificial intelligence", "ChatGPT", "oral diagnosis", "maxillofacial", "oral pathology", "perception", "attitudes", "awareness", "survey" (combined using Boolean operators AND/OR).

#### 3.2.1. Inclusion criteria:

- Peer-reviewed scientific articles
- Published in English between 2019 and 2025
- Indexed in PubMed or Medline
- Studies involving healthcare professionals (dentists, physicians, oral and maxillofacial clinicians)
- Evaluation of perceptions, attitudes, awareness, or acceptance of artificial intelligence in diagnostic practice

3.2.2. Exclusion criteria:

- Studies focused only on technical development or performance of AI systems
- Studies involving only patient populations
- Review articles, editorials, commentaries
- Non-peer-reviewed publications (e.g., preprints)

### 3.2.3. Flow diagram

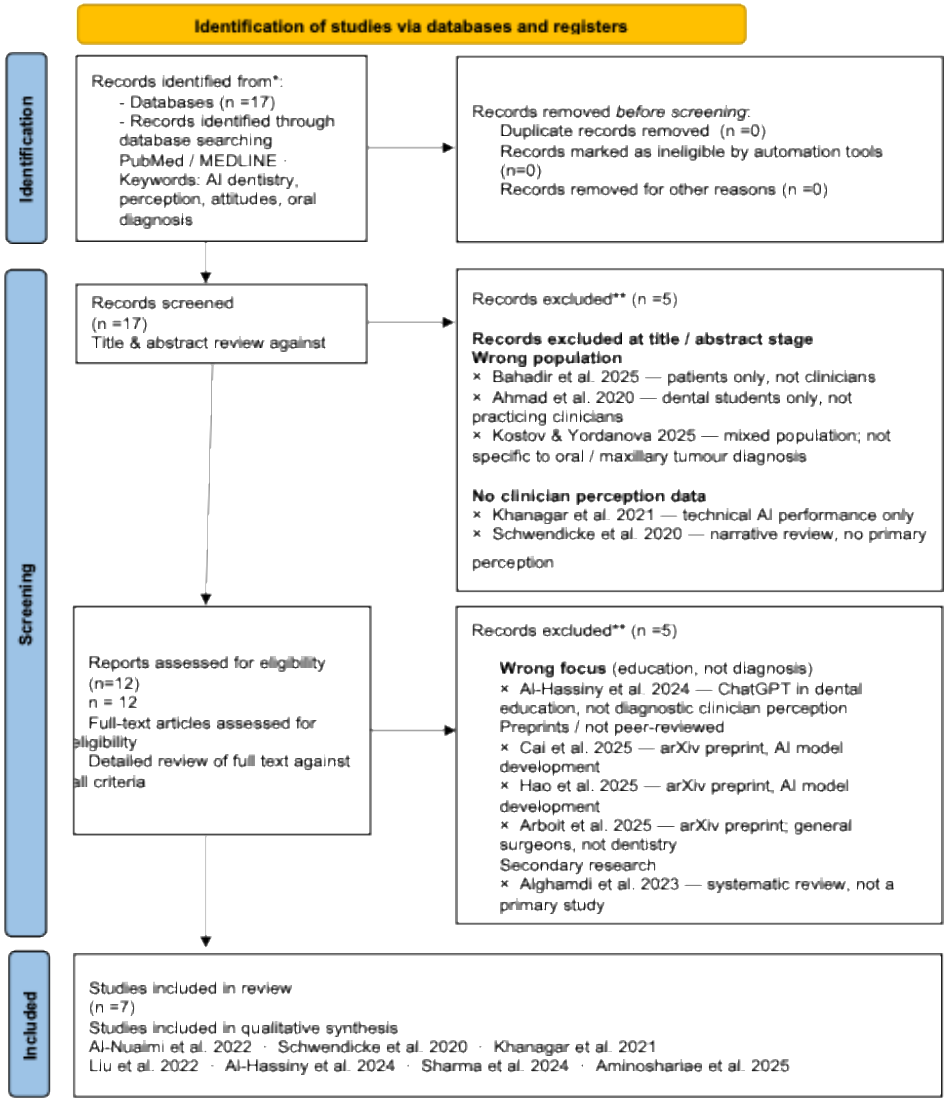



**Figure 5.** PRISMA Flowchart of the included reports in the study

Source : Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

### 3.3. Questionnaire

#### 3.3.1. Development of questionnaire

A specific questionnaire was created using Microsoft Forms. It was structured into four main parts:

1. Participant Background

   Including the: Specialty, level of training, and clinical experience.

2. Experience With Maxillary Tumors

   How often participants encounter these lesions, which diagnostic tools they use (CBCT, panoramic radiographs, biopsy), and their level of confidence.

3. Familiarity With Artificial Intelligence

   Whether participants know or use ChatGPT, and for which purposes.

4. Perceptions of ChatGPT in Diagnosis

   Expected benefits, concerns, potential risks, ethical questions, and general attitudes.

The questionnaire included multiple-choice questions, 5-point Likert scales, and a few open-ended questions to allow participants to express their opinions more freely.

#### 3.3.2. Pilot Testing and Validation

Before the official distribution, the form was tested by a small group of 5 dental students and 2 dentists.

Based on their feedback, minor adjustments were made to improve wording clarity and question flow. After thoses tests, the questionnaire was sent to the ethnic commission that validated it.

#### 3.3.3. Distribution and Participants

The questionnaire was distributed electronically through:

- university email lists,
- professional dental groups,
- and social media platforms.

Participation was voluntary and anonymous. Inclusion criteria were simply being a dental student or a practicing dental professional and agreeing to participate.

No identifiable personal data were collected.

## 3.4. ChatGPT Clinical Simulation

#### 3.4.1. Selection of Clinical Scenarios

To assess ChatGPT's diagnostic reasoning, we created a series of standardized clinical vignettes representing common and clinically relevant maxillary lesions, including:

- Odontogenic tumors (e.g., ameloblastoma)
- Cystic lesions (e.g., odontogenic keratocyst, dentigerous cyst)
- Fibro-osseous lesions
- Maxillary sinus tumors
- Malignant lesions (e.g., squamous cell carcinoma)
- Pseudo-tumoral conditions

Each case included a short but detailed clinical description:

patient age, symptoms, anatomic location, clinical examination, and radiographic features (including CBCT characteristics when relevant).

### 3.4.2. Interaction with ChatGPT

For each clinical vignette, ChatGPT (GPT-5.1) was asked to:

1. Interpret the key radiographic or clinical signs
2. Generate a differential diagnosis
3. Explain its reasoning
4. Suggest appropriate next diagnostic steps (imaging, biopsy, referral)

To avoid bias, ChatGPT was reset between cases so that each vignette was analyzed independently.

### 3.4.3. Evaluation of ChatGPT's Responses

ChatGPT's answers were evaluated by comparison with the official diagnoses provided on the clinical case simulation website.

The following aspects were assessed:

- the accuracy of the proposed differential diagnosis,
- the correctness of radiographic interpretation,
- the relevance and safety of the diagnostic recommendations,
- the ability to identify malignant signs or red flags.
- Discrepancies between ChatGPT's responses and the official diagnoses were analyzed and discussed.

# 4. RESULTS

## 4.1. Overview and Sample description

This chapter reports and discusses the findings of a questionnaire administered to 111 dental and oral healthcare professionals out of which i have selected only a 100. The survey explored how familiar they are with artificial intelligence (AI) tools, how much they trust these systems in a clinical setting, what ethical concerns they raise, and how they envision AI shaping diagnostic practice in the years ahead. A particular emphasis was placed on large language models, specifically ChatGPT and their possible role in the diagnosis of tumour and tumour-like lesions of the maxilla. The survey findings are set against the evidence gathered from the seven peer-reviewed articles included in this thesis's literature review, and the degree of overlap between the two data sources is discussed in detail.

The respondents came from a variety of clinical backgrounds. As illustrated below (Figure 6), general dentists made up the largest share of the sample at 32%, trailed by dental students and residents (23%), oral and maxillofacial surgeons (14%), oral and maxillofacial radiologists (13%), oral pathologists (11%), and others (7%). In terms of experience, 35% had been practicing between six and ten years, and 25% for more than a decade. Only 13% had fewer than two years of practice. This breakdown matters because it tells us that the bulk of respondents are not newcomers, they already have formed habits, clinical intuitions, and an established sense of where technology fits into their daily work.

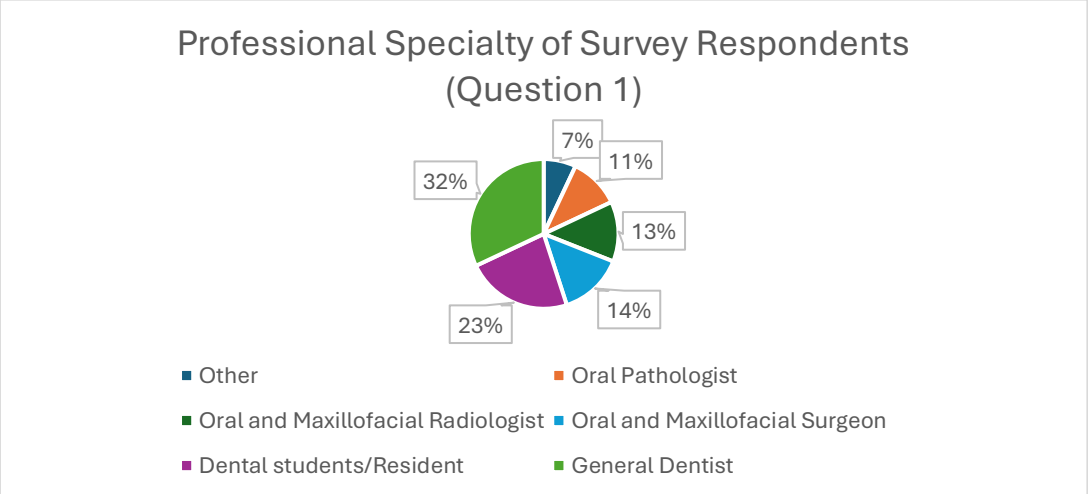



**Figure 6:** Professional Specialty of survey respondents (Question1)

### 4.2. Diagnostic Challenges in Maxillary Tumour Lesions

Before turning to perceptions of AI, it is worth understanding what clinicians actually find hard about diagnosing maxillary tumours, since this sets the stage for determining where an AI tool could realistically help. Question 5 of the survey asked respondents to name the stage they considered most challenging. The answers, shown below, reveal a clear hierarchy.

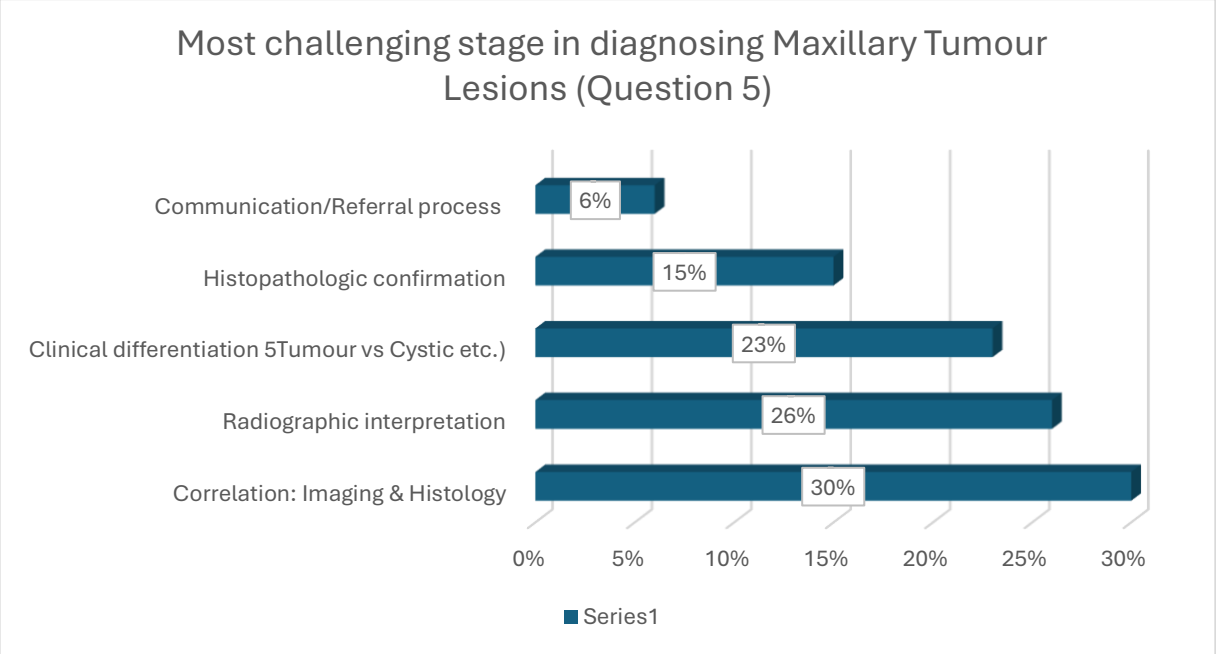



**Figure 7:** Most challenging stage in diagnosing Maxillary Tumour lesions (Question 5)

Correlating imaging findings with histopathology came out on top, flagged by 30% of respondents. Radiographic interpretation followed closely at 26%, and clinical differentiation between a tumour, a cyst, and an inflammatory lesion accounted for 23%. What is immediately striking about these results is that the two most cited difficulties, reading radiographs and tying imaging to histology. It happen's to be exactly the areas where AI and language-model tools have been proposed as decision aids.(35)(38) That the felt needs of clinicians and the proposed applications of AI overlap so directly is a meaningful finding in itself: it suggests that the clinical community's intuitive openness to AI support is grounded in real practical difficulty, not merely in curiosity about new technology.

## 4.3. Prior Exposure to AI Diagnostic Tools

### 4.3.1. Survey Results

Question 6 asked whether respondents had ever tried an AI-based diagnostic tool in dentistry or radiology. The answer, illustrated below, is fairly unambiguous: awareness is common, but hands-on use is rare. More than half 54% and said they had heard of these tools but had never actually tried one. A further 31% reported having no contact with AI diagnostic tools whatsoever.

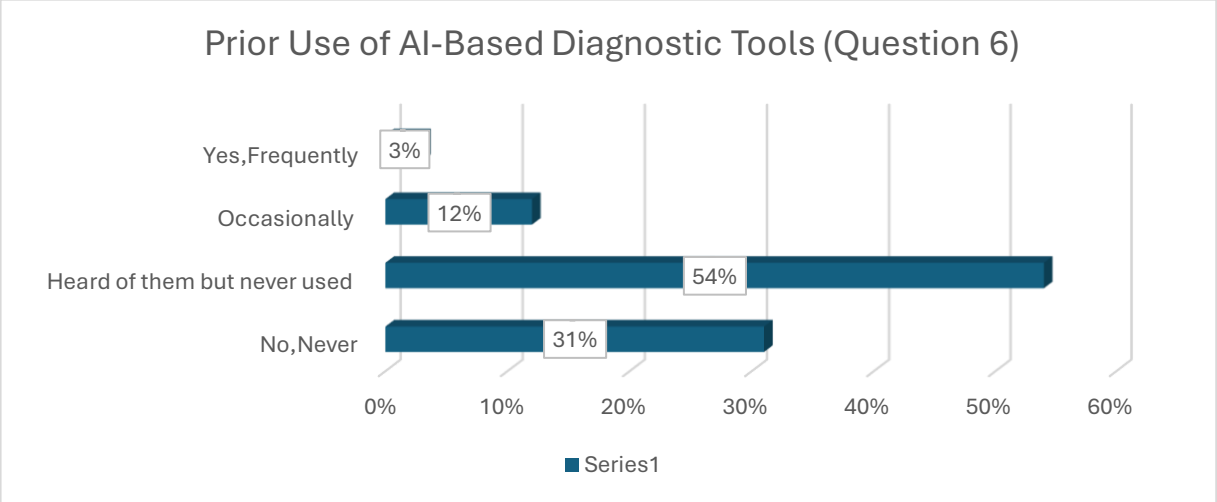



**Figure 8:** Prior Use of AI- Based Diagnostic Tools (Question 6)

At the other end, only 3% used them regularly, and 12% had experimented with them at some point. Taken together, 85% of respondents have never meaningfully engaged with AI in a clinical or diagnostic context. That figure stands out, especially given how much attention AI in healthcare has received in recent years.

### 4.4. Confidence in AI Systems for Clinical Diagnosis

#### 4.4.1. Survey Results

Question 7 asked respondents to score their confidence in current AI systems, ChatGPT and imaging-based tools alike for supporting clinical diagnosis, on a five-point scale from no confidence to very high confidence. The result is shown below, and the pattern is hard to misread. Exactly 50% of respondents landed on score 3, the midpoint. Score 4 came in at 23%, and only 9% chose the highest rating. At the other end, 15% rated their confidence as low, and 3% expressed no confidence at all. The distribution is not one of enthusiasm or of hostility, it is one of measured, cautious openness. These are people who can see the potential but are not yet willing to trust it without reservation.

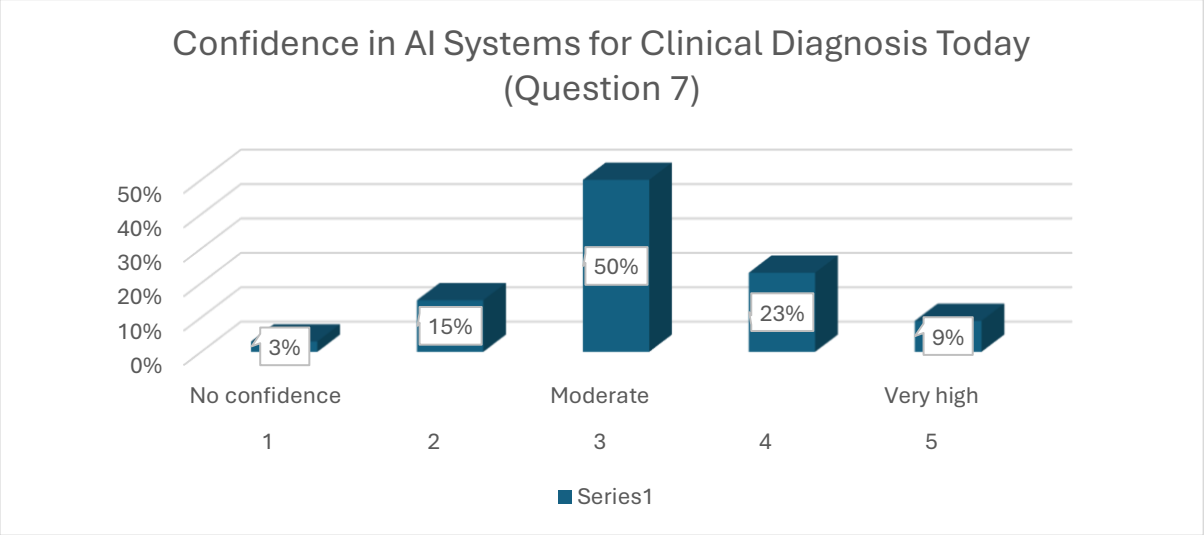



**Figure 9:** Confidence in AI Systems for Clinical Diagnosis Today (Question 7)

### 4.5. Perceived Clinical Utility of AI in maxillary diagnosis

#### 4.5.1. Most useful diagnostic Task (Q8)

Question 8 invited respondents to pick the diagnostic task where they felt AI could add the most value. The answers were fairly concentrated, as shown in the figure below.

Detection of radiolucent or radiopaque lesions came first, chosen by 48% of participants, an outright majority on its own. Differential diagnosis generation came second at 24%. Together, these two tasks account for 72% of all responses. The remaining options, referral decision support, educational use, and documentation. Each captured far smaller shares. The message is clear: when clinicians think about what AI could do for them, they think about radiographic reading and differential diagnosis.

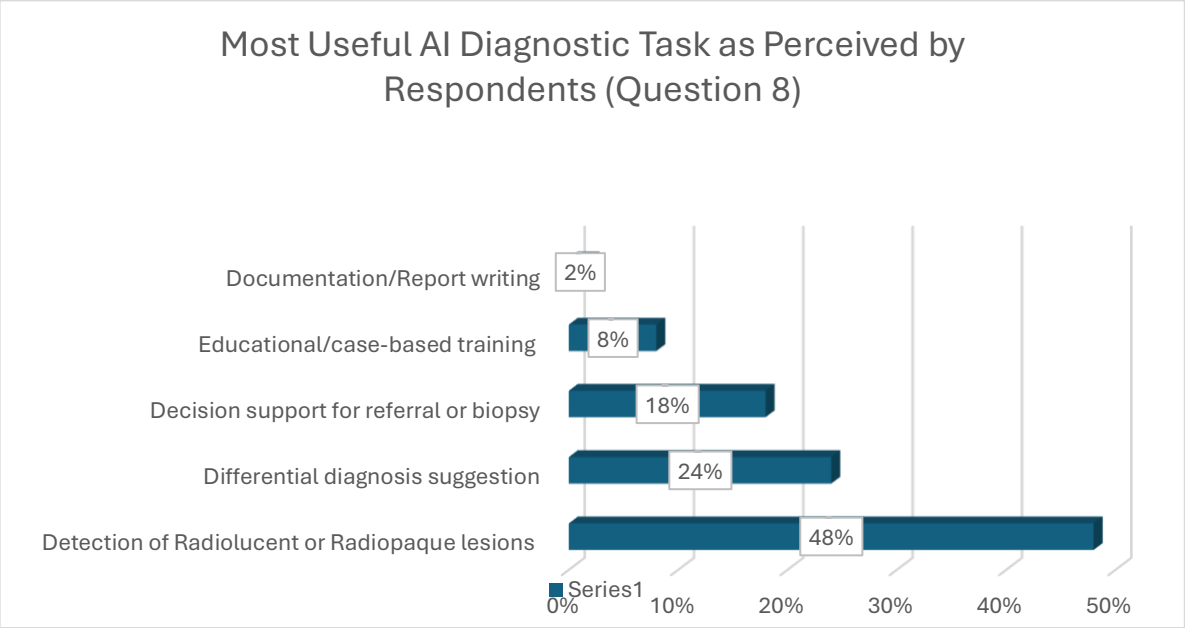



**Figure 10:** Most useful AI diagnostic Task as perceived by respondents (Question 8)

### 4.6. Ethical, Legal, and Reliability Concerns

#### 4.6.1. Behavior When AI Contradicts Clinical Judgement (Q12)

Question 12 presented a specific scenario: the AI output disagrees with your own clinical impression. What do you do? The answers, shown below, paint a coherent picture. Al-Hassiny et al. reported nearly identical findings, with only 3.8% of respondents prepared to trust AI without human review.(40) Sharma et al. found that human clinical experience was consistently preferred for final diagnostic decisions.(39)The underlying science supports this posture: Aminoshariae et al. showed that AI's tendency to over-diagnose means clinicians are right to apply scrutiny rather than accept AI output at face value.

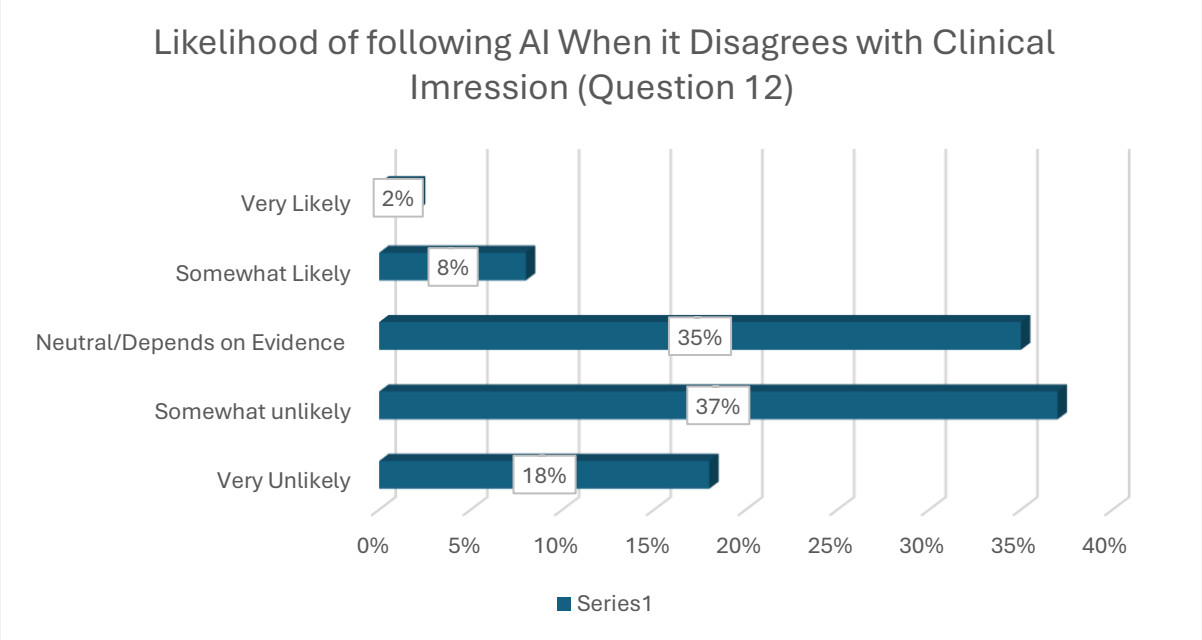



**Figure 11:** Likelihood of following AI When it Disagrees with Clinical Impression (Question 12)

### 4.7. Conditions Required for Clinical Integration

#### 4.7.1. Local Validation Importance (Q15)

Question 15 asked how important it was that any AI system used in diagnosis be validated on local population data in the same region, same imaging equipment. The answer, shown below, was about as emphatic as survey responses get.

Seventy-two percent selected the maximum score of 5 as extremely important. A further 18% scored it a 4. In other words, 90% of respondents regard local validation as a high or top priority. This is not a marginal concern. It reflects a well-founded worry that AI systems trained predominantly on data from North American or European hospitals may simply not perform adequately on patients imaged in different settings, with different equipment, from different demographic backgrounds. Schwendicke et al. flagged exactly this issue, raising questions about the generalisability of AI models across clinical contexts.(35) The respondents are telling us in large numbers that a model which works well in Boston may not be trusted in Riyadh or Paris, and that any AI tool brought into clinical practice must demonstrate its performance locally before being trusted clinically.

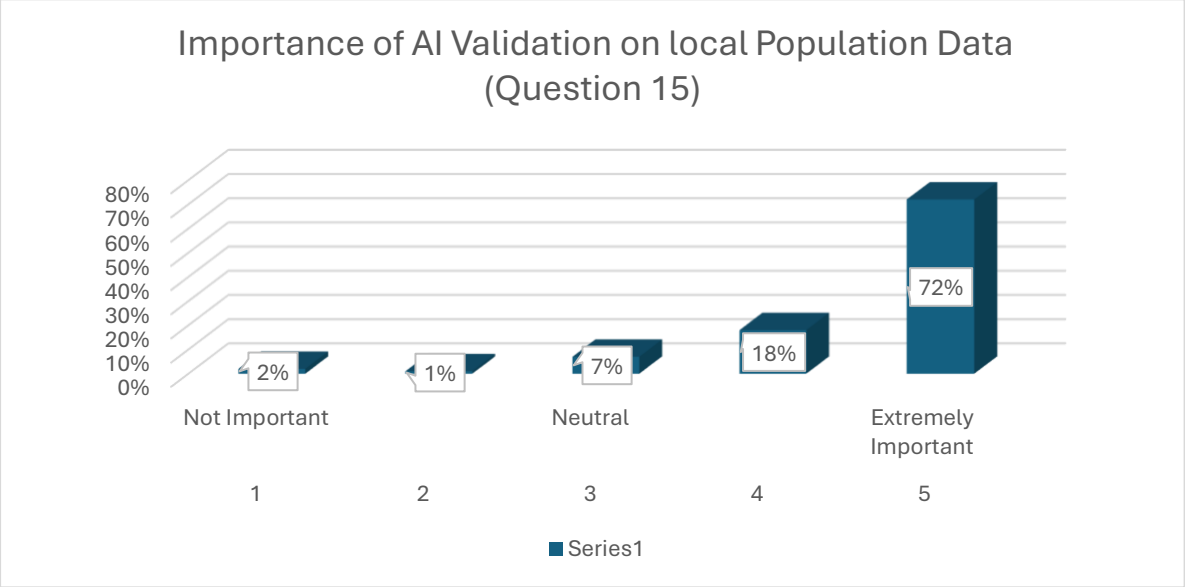



**Figure 12:** Importance of Ai validation on local population data (question 15)

### 4.7.2. Performance Threshold for Routine Integration (Q18)

Question 18 asked what it would take in terms of AI performance and for respondents to incorporate AI into their routine practice. The result, shown below, reframes the question entirely.

More than half, 51% said they would only integrate AI if it had received approval from an official health authority. Not: if it was as accurate as a senior clinician (19%). Not: if it matched the gold standard (20%). Not even: if it was measurably better (10%). The dominant condition is regulatory. Clinicians are essentially saying: even if you show me good numbers, I will not bring this into my practice unless someone with institutional authority has signed off on it. That is a striking finding, and it makes sense when viewed alongside the legal concerns that came out of Q13. If the legal landscape is unclear, practitioners are going to wait for a body with the authority and legitimacy to resolve that ambiguity before they expose themselves.

Liu et al. found that legal liability was the leading barrier to adoption regulatory approval is, almost by definition, the mechanism by which that barrier gets addressed.(37) Al-Hassiny et al. confirmed that trust was conditional on professional authority endorsement.(40) Schwendicke et al. explicitly advocated for validated and ethically reviewed integration frameworks as a prerequisite for clinical adoption.(35) All three align with what the survey is telling us: the bottleneck is institutional, not technological. Better AI will not drive adoption. Better regulation and professional endorsement will.

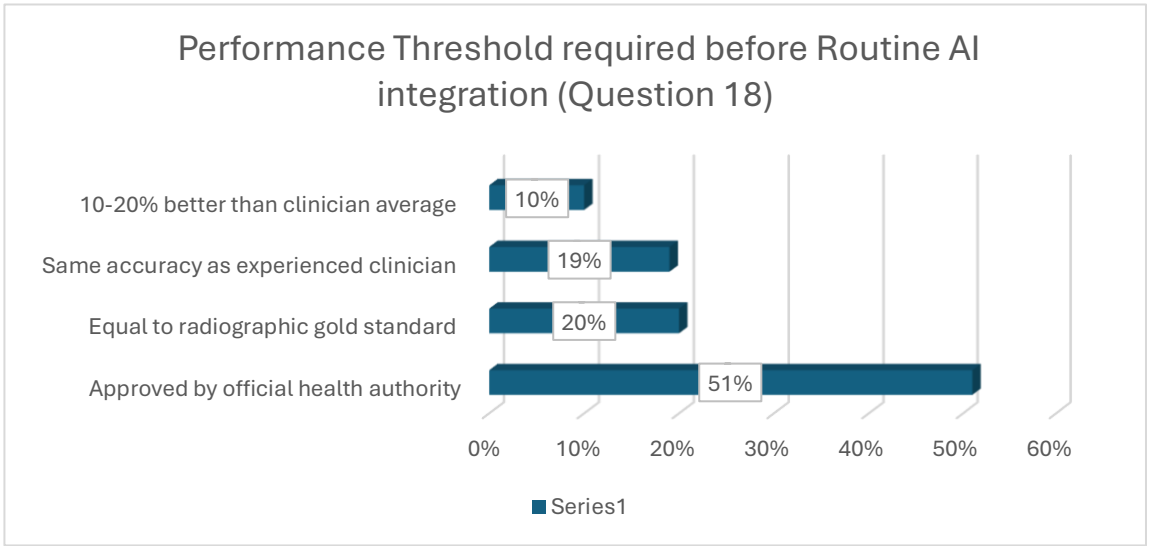



**Figure 13:** Performance Threshold required before Routine AI integration (Question 18)

### 4.8. Educational Interest and Future Outlook

#### 4.8.1. Educational Use of ChatGPT (Q19)

Question 19 shifted the focus slightly, asking whether respondents would be interested in using ChatGPT as a learning tool for diagnosing oral and maxillary lesions not in live clinical practice, but in an educational context. The result, shown below, reveals a more open attitude than the clinical questions might suggest.

Fifty-six percent responded with “possibly, if validated and supervised” conditional interest, not rejection. A further 15% were definitively interested. Only 14% said no outright. The dominant position is one of cautious openness: willing to engage with AI, provided the guardrails are in place. That conditional qualifier “validated and supervised” has now appeared in several survey responses and represents a consistent theme: it is not that professionals do not want AI, it is that they want it properly governed.

Al-Nuaimi et al. identified the absence of training and educational resources as the single most important reason clinicians had not adopted AI.(36)This creates an interesting circularity: professionals need training to gain confidence in AI, but the tools with which to deliver that training are themselves distrusted because they have not been validated. Educational deployment lower stakes, explicitly supervised, used as a teaching aid rather than a clinical

oracle may be the way out of that loop. It offers a way for AI to build a track record in the profession before it enters the consulting room.

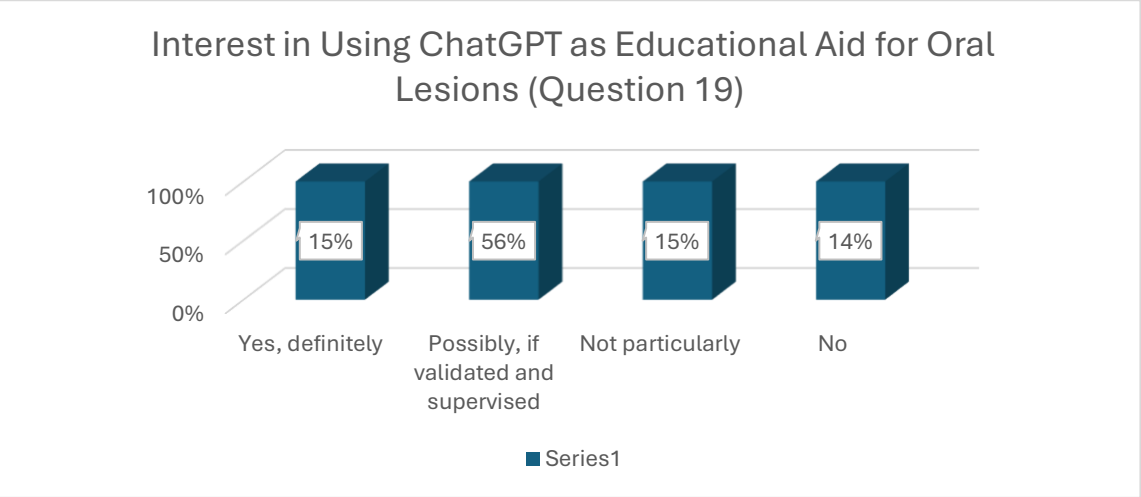



**Figure 14:** Interest in Using ChatGPT as Educational Aid for Oral Lesions (Question 19)

### 4.8.2. Future Outlook (Q20)

Question 20 asked respondents to characterize, in broad terms, what they expected AI to do to diagnostic dentistry over the next five to ten years. The answers, shown below, are dominated by one perspective.

Fifty-nine percent foresaw a supportive role like AI that assists clinicians but does not displace them. A further 21% were more optimistic, expecting AI to become a routine part of diagnostic workflows. Together, 80% anticipated a meaningful positive contribution from AI. Only 10% predicted little impact, and another 10% worried about negative consequences such as overreliance.

This survey result finds an almost exact parallel in the literature. Al-Nuaimi et al. reported that 75% of the dental professionals they surveyed believed AI would significantly advance the field, not by replacing clinicians, but by supporting them.(36) Al-Hassiny et al. specifically confirmed that participants preferred AI in a decision-support role rather than an autonomous one.(40)

Khanagar et al.'s systematic review concluded that AI "must remain adjunctive to clinicians." (38) Schwendicke et al. argued throughout that clinician supervision was indispensable in any AI-assisted workflow. (35) This consistency is worth underlining: the adjunct model is not a compromise position or a hedge it is the settled view of the profession, and it is supported by evidence from every study in this review.

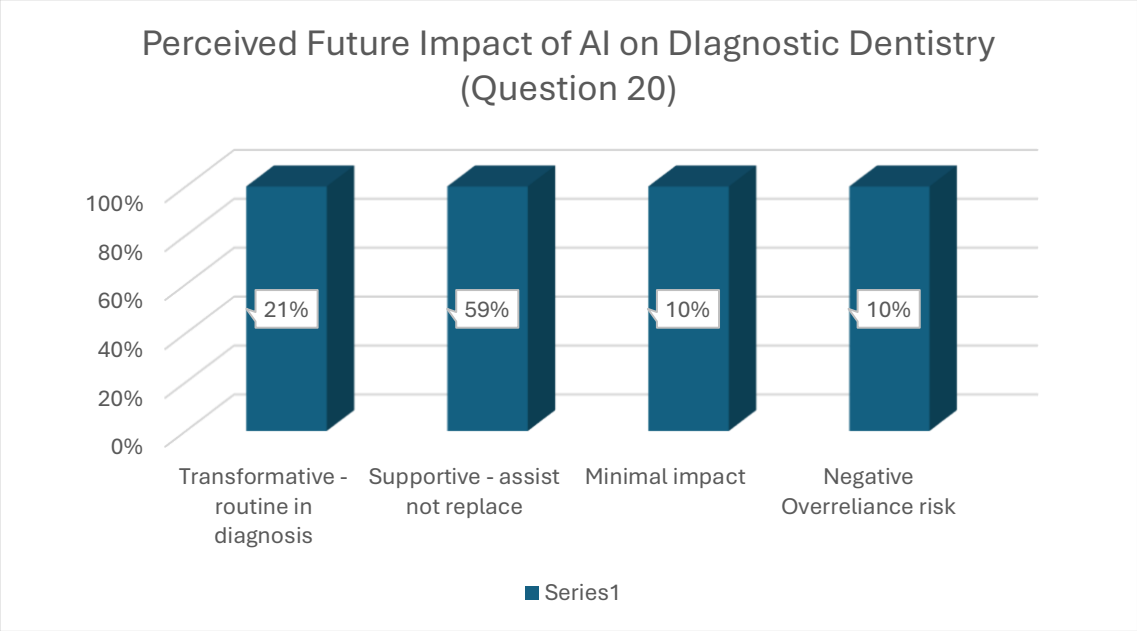



**Figure 15:** Perceived Future Impact of AI on Diagnostic Dentistry (Question 20)

### 4.9. ChatGPT Clinical Simulation:

#### 4.9.1. Case 1: Primordial Odontogenic Tumour (5-year-old, Anterior Maxilla)

ChatGPT correctly identified the expansile lytic cone beam computed tomography pattern as distinguishing the lesion from a simple odontoma and included primordial odontogenic tumour in its differential alongside adenomatoid odontogenic tumour. It recommended biopsy and ophthalmological monitoring given the orbital floor elevation. Performance was strong considering the extreme rarity of this entity (29).

#### 4.9.2. Case 2: Odontogenic Keratocyst (37-year-old Woman, Left Maxilla)

The model ranked odontogenic keratocyst as its primary diagnosis, correctly citing the sclerotic border, homogeneous radiolucency, and multi-tooth extension. It retained ameloblastoma as a differential, recommended aspiration cytology, and proactively flagged the high recurrence risk. A textbook performance on a well-documented lesion type (30).

#### 4.9.3. Case 3 — Ossifying Fibroma (18-year-old Woman, Right Maxilla)

ChatGPT correctly prioritized ossifying fibroma and differentiated it from fibrous dysplasia using specific radiographic criteria. It appropriately included low-grade osteosarcoma as a safety-net differential. Minor gap: limited discussion of the orbital implications of the infraorbital extension (31).

#### 4.9.4. Case 4 — Nuclear Protein in Testis Carcinoma of the Maxillary Sinus (41-year-old Man)

The model immediately flagged malignancy, correctly prioritized squamous cell carcinoma on probabilistic grounds, and spontaneously mentioned Nuclear Protein in Testis carcinoma as a differential to pursue when standard immunohistochemistry is inconclusive, a sophisticated clinical point. It fell short on the molecular detail of the Bromodomain-containing protein 4 and Nuclear Protein in Testis gene fusion pathway that drives targeted therapy decisions (32).

#### 4.9.5. Case 5 — Ameloblastic Carcinoma (59-year-old Man, Right Maxilla)

The strongest performance in the series. ChatGPT ranked ameloblastic carcinoma first, identified every major red flag including cortical destruction, orbital invasion, midline crossing, and tooth mobility, recommended staging computed tomography, and included primary intraosseous squamous cell carcinoma as an alternative. Reasoning was detailed, accurate, and clinically safe throughout (33) .

#### 4.9.6. Case 6 — Inflammatory Pseudotumour (52-year-old Woman, Left Maxilla)

The model correctly identified inflammatory myofibroblastic tumour and inflammatory pseudotumour as the leading diagnosis, interpreted the storiform histological pattern accurately, and recommended Anaplastic Lymphoma Kinase immunostaining. It maintained appropriate vigilance toward low-grade sarcoma. Key omission: Immunoglobulin G4-related disease, which shares this presentation and is increasingly recognised, was not mentioned (34)
.

# 5. DISCUSSION

## 5.1. The Awareness–Adoption Gap: A Structural Problem

Perhaps the most fundamental finding of this study is the persistent gap between professional awareness and clinical use. Fifty-four percent of respondents knew about AI diagnostic tools but had never used one; forty-nine percent had heard that ChatGPT could assist with radiographic analysis but had never witnessed it in practice. And yet, across every future-focused question, the same professionals expressed genuine openness to AI as a supportive tool. That is not a contradiction, it is a description of a profession waiting for conditions that do not yet exist.

This gap between awareness and actual use is well documented in the literature and is not unique to this sample. Al-Nuaimi et al., in a cross-sectional study of 389 dentists and dental students, found that while roughly half were aware of AI, only around 25% had ever used it in practice.(36) Liu et al. surveyed 302 dentists and maxillofacial specialists and reported that 66.9% had never brought AI into their clinical routine.(37) Sharma et al. reached a similar conclusion, noting that awareness sat at 70.9% while actual deployment remained marginal.(39) Across all three studies, the explanation is consistent: it is not that practitioners reject AI in principle, it is that they have had no viable opportunity to learn and apply it. Formal training is absent, accessible tools are few, and institutional support is essentially non-existent.

Al-Nuaimi et al. pinpointed the problem precisely: a shortage of training and educational infrastructure, not hostility to AI, accounts for non-adoption.(36) The conditionality running through so many responses in this survey, "possibly, if validated"; "only if officially approved" makes the same point in different words. Practitioners are not closed to AI. They are waiting for validated tools, professional training programmes, clear liability rules, and institutional frameworks. Until those exist, even a willing professional has no safe way to engage. The problem is one of infrastructure, not attitude.

## 5.2. Legal Accountability: The Hidden Priority

The 47% who identified legal responsibility as their primary concern (Q13) cannot be dismissed as a statistical quirk, this was more than double the next concern, accuracy. It signals something important about how professionals are actually thinking about AI risk. They are not primarily

afraid of bad outputs; they are afraid of unresolved liability. If an AI system assists in a diagnosis that turns out to be wrong, who answers for it in front of a regulatory body, a court, or a professional ethics board? At present, nobody has a clear answer to that question. And clinicians know it.

Liu et al. found the same concern at the top of their ranking among 302 clinicians.(37) Schwendicke et al. raised the ethical and legal complexity of AI integration as a structural problem the profession needed to address proactively.(35) This concern also connects directly to conditions for adoption: 51% of respondents stated they would only integrate AI following formal approval by an official health authority, not because its performance was sufficient, but because institutional endorsement functions as the mechanism through which legal ambiguity gets resolved. Regulatory approval is, in effect, the profession's answer to the liability question.

The 60% who chose shared responsibility in Q14 are not trying to avoid the question, they are offering a reasoned position: liability should be distributed across those who design, deploy, and use AI systems, in proportion to the role each plays. That is a coherent argument, and one that healthcare regulators and legal scholars are beginning to take seriously. Schwendicke et al. argued that AI integration generates liability questions that cannot be fairly resolved by pointing to any single actor,(35) and Liu et al. raised similar concerns about how responsibility would be distributed between clinicians and institutions.(37) The preference for shared responsibility expressed in this survey reflects exactly that practically grounded view.

### 5.3. ChatGPT as a Diagnostically Contextualised Tool

The preferences expressed in Q10 (clinical decision support, 34%; explaining radiographic differentials, 32%) and Q8 (detection of radiolucent/radiopaque lesions, 48%; differential diagnosis generation, 24%) point toward where clinicians feel AI can add the most value and these are precisely the tasks where published evidence confirms AI performs best. Khanagar et al., in a systematic review, demonstrated reliable AI performance in caries detection, periodontal assessment, oral cancer screening, and maxillofacial radiology interpretation.(38) Aminoshariae et al. provided targeted evidence within maxillofacial radiology, validating AI's detection capability for periapical pathology.(42) Schwendicke et al. specifically addressed AI's role within radiographic workflows, arguing for its integration as a support tool for image

interpretation.(35) Respondents are not expressing vague enthusiasm that they are pointing, with reasonable precision, to the tasks where empirical evidence says AI currently delivers.

What sets ChatGPT apart from imaging-based AI is the format of its output. An image classifier gives a label and a confidence score. ChatGPT can give a reasoned explanation, something like: "the lesion appears well-defined, with cortical expansion and no periapical involvement, which makes a radicular cyst the most likely diagnosis, though the involvement of the second molar root raises ameloblastoma as a possibility worth excluding." That kind of output directly addresses the "black box" critique that Schwendicke et al. identified as a core obstacle to clinical trust. (35)

This does not mean ChatGPT is ready for unsupervised clinical deployment it is not. But it does mean that the format of its output, natural language, step-by-step reasoning, and explicit acknowledgement of uncertainty, is closer to what the clinical community is asking for than what most current diagnostic AI systems provide. The practical challenge is ensuring that this explanatory fluency is backed by factual accuracy and proper clinical validation, which at present it is not, at least not for the specific context of maxillary tumour diagnosis. Aminoshariae et al. showed that AI sensitivity is high, but specificity is poor, tending to identify lesions that are not there, (42) which scientifically validates the moderate confidence calibration (50% scored 3/5) observed in this survey.

### 5.4. The Adjunct Consensus and Its Clinical Implications

The 59% who anticipated a supportive rather than transformative role for AI (Q20) are sometimes read as conservative or reluctant to embrace change. The evidence in this thesis suggests a different reading. These are professionals who are calibrating their expectations against what they actually know: that AI sensitivity is high but specificity is low;(42) that most AI systems have not been validated on local data, a condition 72% consider essential (Q15); and that no regulatory framework exists to govern AI-assisted decisions. Given all of that, expecting AI to play a supportive rather than autonomous role is not a failure of imagination. It is an appropriate response to the current state of the evidence.

This is also the position adopted by every published study in this review. Al-Nuaimi et al. found that 75% of dental professionals believed AI would significantly advance the field, not by replacing clinicians, but by supporting them.(36) Al-Hassiny et al. confirmed preference for AI as a decision-support tool, with only 3.8% prepared to fully trust an AI diagnosis without any human review.(40) Khanagar et al. insisted AI must remain adjunctive to clinicians.(38) Schwendicke et al. placed clinician supervision at the heart of any legitimate AI-assisted workflow.(35) The consistency across studies from different countries, methodologies, and disciplinary angles is the clearest signal in this entire body of evidence. There is no credible professional voice arguing for autonomous AI in this diagnostic context. The adjunct model is not a temporary compromise; it is where the field currently stands.

Educational deployment may offer a practical route forward. Fifty-six percent of respondents expressed conditional interest in using ChatGPT as a learning tool for maxillary lesion diagnosis (Q19). Al-Nuaimi et al. identified the absence of training resources as the single most important reason clinicians had not adopted AI.(36) Introducing AI in a supervised educational context lower stakes, explicitly governed, used as a teaching aid rather than a clinical oracle, could allow the tool to build a professional track record before it enters the consulting room.

### 5.5. What the Simulation Adds to the Broader Debate

The simulation results provide something that the existing literature largely lacks: a direct, case-by-case test of ChatGPT's reasoning in the specific diagnostic context of maxillary tumour lesions. Most published studies evaluating artificial intelligence in dentistry focus on imaging-based tools applied to caries detection or periapical pathology and domains with large datasets, clear binary outcomes, and well-established benchmarks. Maxillary tumour diagnosis is fundamentally different. It involves rare entities, overlapping radiographic appearances, multi-modal data integration, and in several cases a final diagnosis that depends entirely on molecular pathology rather than any clinical or radiographic feature. The fact that ChatGPT performed creditably across this spectrum, reaching the correct primary diagnosis in five of six cases and including it in all six suggests that its utility extends beyond the routine diagnostic scenarios studied in the literature. At the same time, the gaps identified in Cases 4 and 6 serve as a concrete reminder that language model performance is not uniform across diagnostic complexity. The model reasons well from established clinical knowledge but has an identifiable

ceiling when the diagnosis hinges on emerging molecular classifications or recently reclassified entities. This distinction is reliable on the well-documented, limited on the frontier is clinically important and should inform how any future integration of ChatGPT into diagnostic workflows is structured, supervised, and communicated to practitioners

### 5.6. Limitations

A number of limitations should be acknowledged honestly. All perception surveys carry the risk of social desirability bias, people may report attitudes that reflect how they think they ought to feel rather than what they actually do. Most importantly, the specific application of ChatGPT to the diagnosis of maxillary tumour lesions remains almost entirely unstudied as a distinct topic, and several of the conclusions drawn here rest on extrapolations from more general AI-in-dentistry literature. Prospective, locally validated, real-patient studies in this specific diagnostic area would substantially strengthen the evidence base that this thesis has had to work around.

# 6. CONCLUSION

1. This thesis set out to evaluate whether ChatGPT can meaningfully assist dental and medical practitioners and students in interpreting diagnostic information related to maxillary tumours identifying key features, generating differential diagnoses, and explaining histological terminology. The findings from both the clinical simulation and the survey of 100 oral healthcare professionals converge on the same conclusion: ChatGPT is a promising but not yet clinically validated tool, whose integration into diagnostic practice depends far less on its technical performance than on the regulatory, institutional, and educational conditions surrounding it.

2. In comparing ChatGPT's diagnostic reasoning with conventional approaches, genuine but bounded utility emerged. Across all six clinical cases, ChatGPT included the correct diagnosis in its differential and ranked it first in five, performing creditably even on rare entities such as primordial odontogenic tumour and ameloblastic carcinoma. Its transparent, step-by-step reasoning directly addresses the explainability concern that clinicians consistently raise about artificial intelligence tools. However, identifiable gaps appeared in molecularly defined and recently reclassified conditions a ceiling that reflects limitations relative to established expert judgment and current literature, and one that makes supervised use not merely preferable but necessary.

3. The diagnostic simulation confirmed that ChatGPT can serve as a functional decision-support tool when tested against real clinical and radiographic case scenarios, holding its own in structured comparison with trained clinicians' reasoning. Simultaneously, the survey revealed a consistent awareness–adoption gap: eighty-five percent of respondents had never used artificial intelligence in a diagnostic context, despite widespread awareness and genuine openness. Legal accountability emerged as the dominant concern, outweighing accuracy, privacy, and overreliance. The conditions cited for adoption local validation and official health authority approval reveal that the main barrier is institutional, not technological. The profession is not waiting for better artificial intelligence; it is waiting for governance frameworks that make its use legally and professionally defensible.

4. Across all data sources, one position prevails unanimously: artificial intelligence as adjunct, not replacement. ChatGPT's most realistic and appropriate role in maxillary tumour diagnosis is as a decision-support tool that assists the clinician in interpreting radiographic findings, structuring differential diagnoses, and accessing synthesised knowledge always under human oversight, never in place of it. Future research should focus on prospective validation studies

using real patient data in maxillofacial settings, and on the development of clear regulatory standards that allow willing professionals to adopt these tools safely.

## 7. SUSTAINABILITY

This thesis does not involve laboratory work, biological samples, or clinical procedures, and therefore carries no direct environmental or biological footprint. Its sustainability relevance lies elsewhere in what it evaluates.

Environmental dimension. Artificial intelligence-assisted diagnosis, if broadly adopted, has the potential to reduce unnecessary imaging by supporting more targeted diagnostic decisions. Fewer redundant cone beam computed tomography scans mean reduced radiation exposure and lower energy consumption associated with imaging equipment a modest but real contribution to sustainable clinical practice.

Social and educational dimension. The survey findings highlight a profession that is open to artificial intelligence but lacks the training infrastructure to engage with it safely. Integrating artificial intelligence literacy into dental curricula would represent a sustainable investment in long-term professional competence, reducing the knowledge gap identified across all surveyed groups without requiring significant material resources.

Economic dimension. ChatGPT is a low-cost, widely accessible tool. Unlike imaging-based artificial intelligence systems that require dedicated software, hardware integration, and institutional licensing, a language model interface requires only an internet connection. This accessibility makes it a potentially equitable resource across different healthcare settings, including those with limited diagnostic infrastructure.

Ethical sustainability. The concerns raised by respondentslegal accountability, explainability, and local validation are not obstacles to sustainability but conditions of it. A technology integrated without governance frameworks is not sustainably integrated. The adjunct model advocated throughout this thesis, in which artificial intelligence supports but never replaces clinical judgment, is itself the most ethically sustainable approach to adoption.

## 8. REFERENCES


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# 9. ANNEXES

**Questionnaire:**

- Accepted by the Ethnic commission, of the département number: OD.078/2526

**Section 1 – Background Information**

Consentment Question.

1. What is your professional specialty?

☐ Oral and Maxillofacial Surgeon

☐ Oral and Maxillofacial Radiologist

☐ Oral Pathologist

☐ General Dentist

☐ Dental Student / Resident

☐ Other (specify): _____

2. How many years of clinical experience do you have?

☐ < 2 years

☐ 2–5 years

☐ 6–10 years

☐ > 10 years

3. How often do you encounter maxillary tumour or tumour-like lesions in your practice?

☐ Daily

☐ Weekly

☐ Monthly

☐ Rarely

**Section 2 – Current Diagnostic Workflow**

4. Which diagnostic methods do you most frequently use for maxillary lesions? (Select all that apply)

☐ Clinical examination

☐ Conventional radiography (periapical, panoramic)

☐ CBCT / CT

☐ MRI

☐ Biopsy and histopathology

☐ Other: _____

5. In your opinion, which stage is the most challenging in diagnosing maxillary tumour lesions?

☐ Radiographic interpretation

☐ Clinical differentiation (tumour vs cystic vs inflammatory lesion)

☐ Histopathologic confirmation

☐ Correlation between imaging and histology

☐ Communication/referral process

**Section 3 – Experience and Perception of AI**

6. Have you ever used or tested any AI-based diagnostic tool in dentistry or radiology?

☐ Yes, frequently

☐ Occasionally

☐ Heard of them but never used

☐ No, never

7. How confident are you in the ability of AI systems (like ChatGPT or imaging AI) to support clinical diagnosis today?

(1 = No confidence, 5 = Very high confidence)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

8. In which type of diagnostic task do you think AI could be most useful?

☐ Detection of radiolucent or radiopaque lesions

☐ Differential diagnosis suggestion

☐ Decision support for referral or biopsy

☐ Educational or case-based training

☐ Documentation / report writing

**Section 4 – ChatGPT-Specific Perceptions**

9. Before this questionnaire, were you aware that ChatGPT or similar AI can analyze and describe radiographic or clinical findings (with proper data input)?

☐ Yes, I've seen examples

☐ I've heard about it but never seen it used clinically

☐ No, I wasn't aware

10. Which potential role of ChatGPT would be most valuable to you in maxillary tumour diagnosis?

☐ Explaining radiographic differentials

☐ Generating structured diagnostic reports

☐ Assisting in clinical decision-making (e.g., next test suggestion)

☐ Summarizing patient data for case discussion

☐ Teaching / learning diagnostic reasoning

11. Which of the following would make you trust an AI diagnosis? (Choose up to 2)

☐ Transparent reasoning or textual explanation

☐ Annotated image or heatmap

☐ Verified clinical validation study

☐ Approval by a professional authority (regulatory or academic)

☐ Positive prior personal experience

**Section 5 – Reliability, Ethics, and Implementation**

12. How likely would you be to rely on an AI suggestion if it disagreed with your clinical impression?

☐ Very unlikely

☐ Somewhat unlikely

☐ Neutral / Depends on evidence

☐ Somewhat likely

☐ Very likely

13. What is your main concern regarding AI-assisted diagnosis?

☐ Accuracy and false results

☐ Lack of explainability (“black box”)

☐ Legal responsibility in case of error

☐ Data privacy and patient confidentiality

☐ Potential overreliance by clinicians

14. In your opinion, who should hold responsibility if an AI-assisted diagnosis leads to an incorrect treatment?

☐ The clinician using it

☐ The AI developer / company

☐ The institution or hospital

☐ Shared responsibility between clinician and developer

☐ Not sure

15. How important is it that AI systems used in diagnosis are validated on local population data (same region, same devices)?

(1 = Not important, 5 = Extremely important)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

**Section 6 – Integration and Utility**

16. How would you prefer to access an AI assistant like ChatGPT for diagnostic help?

☐ Integrated in radiology software (PACS or CBCT viewer)

☐ Web-based platform with case upload

☐ Mobile app

☐ Direct chat interface (text-based)

☐ Other: _____

17. What type of output would be most clinically helpful for you?

☐ A ranked list of possible diagnoses with confidence levels

☐ A detailed textual reasoning explaining the decision

☐ An annotated image highlighting suspicious regions

☐ A summary report ready for the patient's file

18. Which level of AI performance would convince you to integrate it into your routine practice?

☐ Same accuracy as an experienced clinician

☐ 10–20% better than clinician average

☐ Equal to radiographic gold-standard sensitivity/specificity

☐ Only if approved by an official health authority

**Section 7 – Educational and Future Outlook**

19. Would you be interested in using ChatGPT or similar AI as an educational aid for diagnosing oral/maxillary lesions?

☐ Yes, definitely

☐ Possibly, if validated and supervised

☐ Not particularly

☐ No

20. How do you foresee AI impacting the future of diagnostic dentistry within the next 5–10 years?

☐ Transformative – AI will become routine in diagnosis

☐ Supportive – AI will assist but not replace clinicians

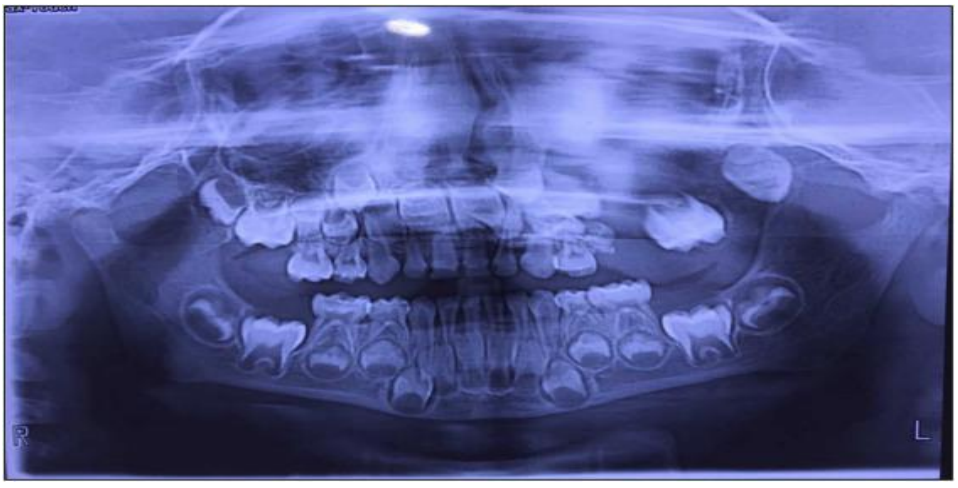
☐ Minimal impact – adoption will remain low

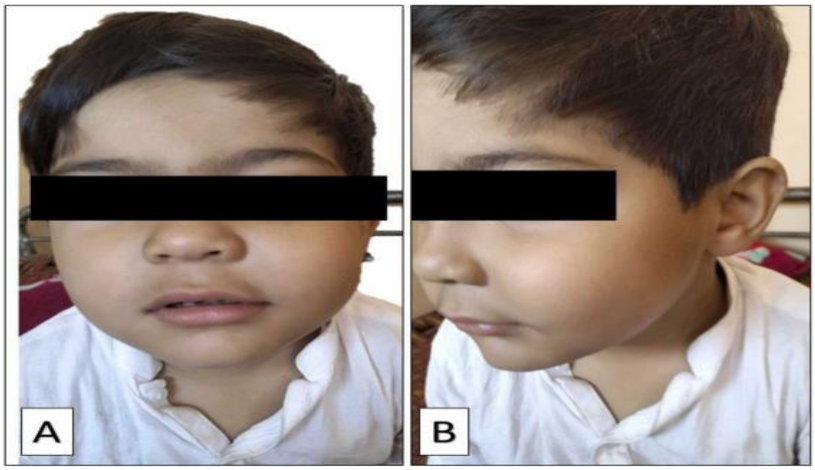
☐ Negative – risk of overreliance and loss of clinical skills

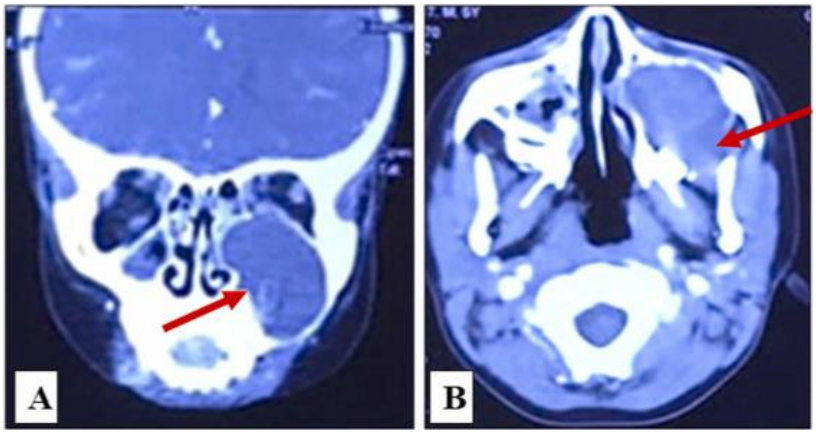
## Clinical cases:

## 1ST: Primordial  Odontogenic Tumor:

(Primordial because the lesion histologically mimics the early stages of tooth development)






(29) Qureshi MF, Ali Q, Amin S, Rauf A, Dhanani R, Ud Din N. Primordial odontogenic tumor of the maxilla: a case report. Surgery Case Reports. 2024;3:100054. doi:10.1016/j.sycrs.2024.100054.

Patient Age/sex: 5 years Old

Location: Anterior Maxillary Region

Symptoms: A left facial swelling for the past three months, mild pain , no past history of discharge, epitaxis ( nose bleeding) or even trauma.

Clinical exam:

-Ressemble to a developing tooth with a large dental papilla

-size: 3*4 cm, non tender extending to the left side of the palate, Overlying mucosa was intact.

-Loss of teeth at the site of the swelling

-No palpable neck nodes

Radiographic Features:

*Orthopantomogram*:

-Mixed dentition stage

-Radio-opaque mass noted in maxillary left region

-Looks like an odontoma

-Maxillary first molar of the right side  was spaced out probably due to the presence of the mass

-Second molar bud also looks abnormal

*CBCT*:

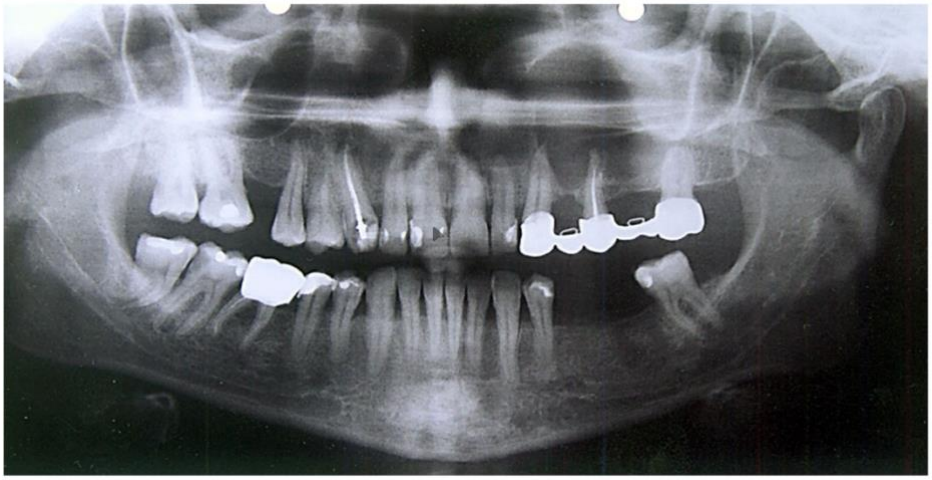
-Facial region with contrast showed an expansile lytic lesion Towards the left maxillary sinus

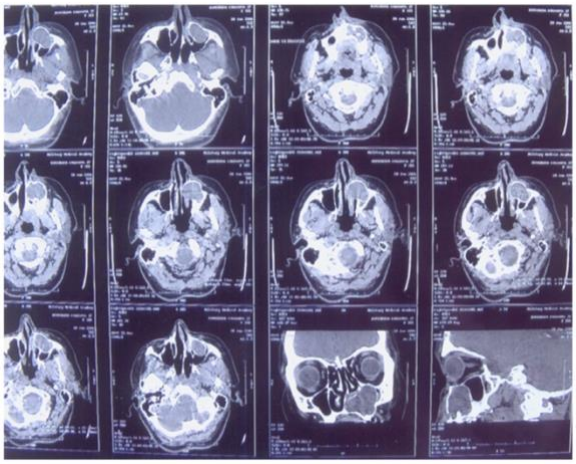
-Thinner maxillary bone

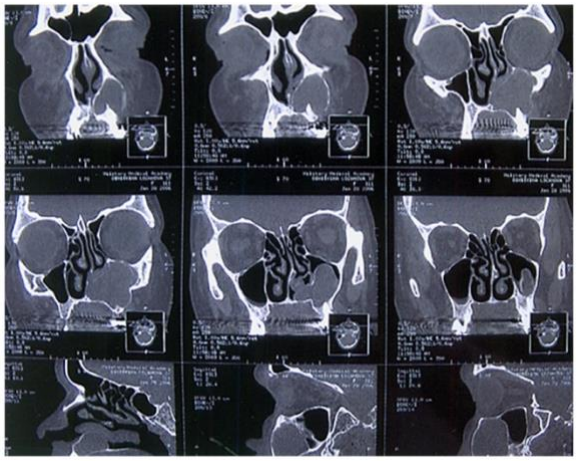
-Elevation of the orbital floor without intra-orbital extensions

-Extension up to the retromolar trigone

## 2nd: Cystic Lesion: (Radiological Features of extensive maxillary odontogenic keratocyst found)







(30) Mihailova H, Kirilov B. Cystic lesion of the maxilla – case report. J IMAB (Annual Proc Sci Pap). 2006;12(2):5–7.

Patient age/sex: 37 Years Old Women

Location: Left side Of the face

Symptoms: painless gradually enlarged for the last 2 months than the last week the pain appeared. (Localized Left maxillary sinus and pulsating)

Clinical exam:

InTraOral exam revealed Expansion of the distal area of the left maxilla, extending towards the buccogingival sulcus. Swelling slightly painful to palpation and with bone thickness. Overlying mucosa was intact, normal in colour and non connected with the bone.

Radiographic Research:

*Orthopantomogram*:

-Present an ovoid well demarketed with osteosclerotic border radiolucent lesion on the left maxilla extending from 21 to 27 measuring 4cm in diameter

-Radiolucency is homogenious, well delineated inferiorly reaching the area of premolars near the alveolar crest including the apical one third of the root of 25.Superiorly up to the left maxillary sinus; medically radiolucency reaches the apex of 21 and dismally near the root of 27.

*CBCT*:

-Polycystic formation which is localized in the base of the nasal and maxillary cavities expanding ventrally the anterior wall of the maxilla

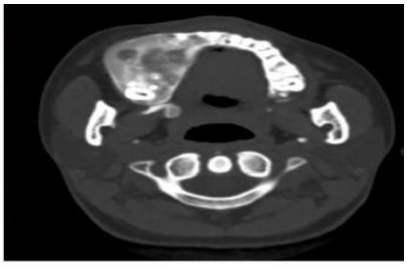
## 3rd: Fibro-Oseous Lesion




(A) (B)



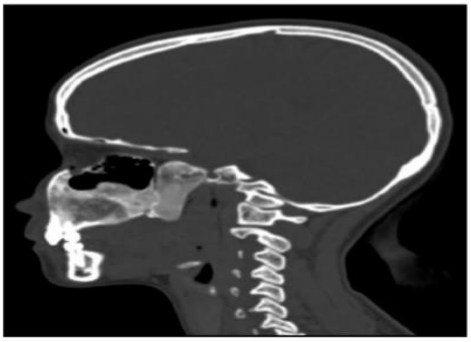
(A)



(B)



(C)



(D)

(31)Tompodung LM, Sensusiati A. Ossifying fibroma of the maxilla: A case report with literature review. Radiology Case Reports. 2023;19(3):915–921. doi:10.1016/j.radcr.2023.10.059. PMCID: PMC10767277.

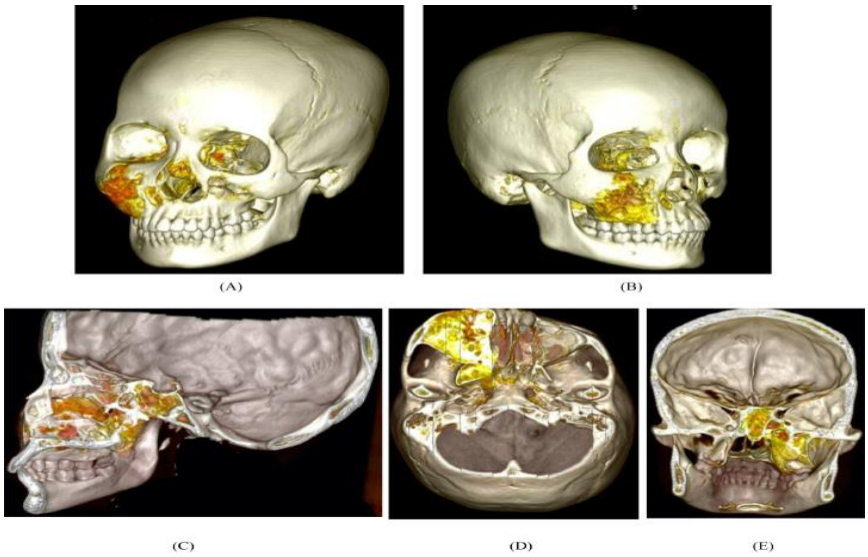
Patient Age/sex: 18 Years old Female

Location: Right Maxilla Region extanding to the infraorbital Region displacing nasal bone to the left side.

Symptoms: Asymptomatic lump for 7 years

Clinical Exam/History : She denied having history of toothache or trauma in the jaw.

InTraOral exam showed a lump that was solitary, solid, not ulcerated and firm in consistency from maxillary region 13-17 expansion to the palatal area of tooth 17, no midline shift was seen .




Radiographic Research:

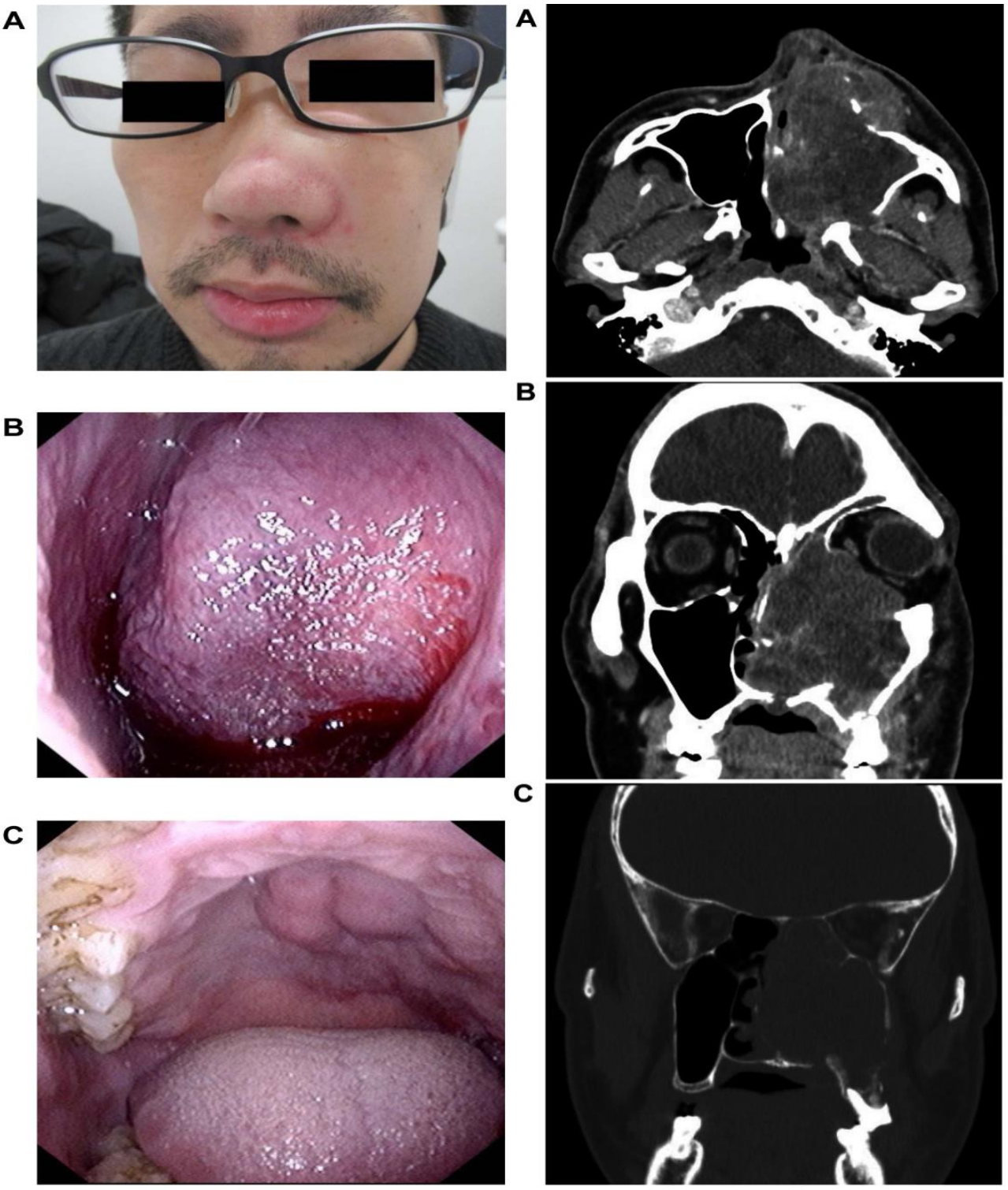
*Orthopantomogram*:

Size: 4cm mixed bone density lesion with diffused margin around the root of teeth 14,15,16,17, and 18 with tooth resorption. It extends from alveolar process to the maxillary sinus.

*CBCT*:

Non-contrast computed tomography revealed a solid hyperdense mass, extensive bone expansion with intact cortex and corticomedullary differentiation in the right sphenoid bone, pterygoid bone to the alveolar process with well-defined margin, measuring approximately 6.4 × 4.0 × 4.5 cm. The mass filled the right maxillary and sphenoid sinus, causing erosion of the palatine bone and pushing the right nasal concha to the left side.

## 4Th: Maxillary sinus tumors




(32)Arai S, Tomioka R, Ueda Y, Shimizu A, Okamoto I, Tsukahara K. Maxillary sinus NUT carcinoma: a case report. Cancer Diagn Progn. 2024;4(3):370–378. doi:10.21873/cdp.10334. PMCID: PMC11062161.

Patient Age/sex: 41 Years-old Male

Location: Mass in the left nasal cavity and the left part of the hard palate

Symptoms: nasal obstruction and left-sided buccal swelling.

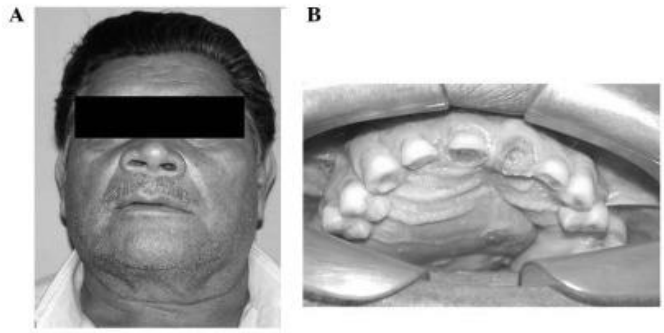
Clinical Exam/History: he had smoked 10 cigarettes a day between the ages of 20-30 years and drank alcoholic beverages only occasionally.

Initial examination revealed swelling and ocular deviation of the left cheek (Figure column 1A), a mass in the left nasal cavity (Figure column 1B) on nasal fibroscopy, and a ridge on the left side of the hard palate in the oral cavity; no mucosal irregularity was observed (Figure column 1C)

Radiographic Research:

*CBCT*: Sinus Computed Tomography (CT) revealed a soft shadow filling the left maxillary sinus, bone destruction, and invasion beyond the hard palate and nasal septum. Involvement of the ethmoidal and frontal sinuses.

## 5th: Malignant Lesion






(33)França DCC, Moreira Jr JM, Ávila de Aguiar SMH, Aburad de Carvalhos A, Goiato MC. Ameloblastic carcinoma of the maxilla: a case report. Oncology Letters. 2012;4(6):1297–1300. doi:10.3892/ol.2012.937. PMCID: PMC3506750.

Patient Age/sex: 59 Years-Old Male

Location: Right side of the maxilla, extending to the left side

Symptoms: The patient reported to have been experiencing bone pain and swelling for two months. The swelling gradually increased, reaching a size which caused the patient difficulty in eating, speaking and swallowing for 2–3 months

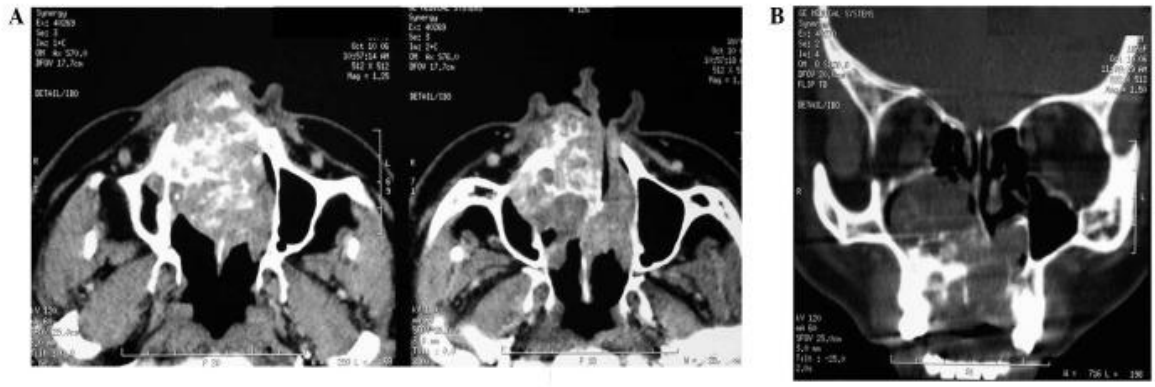
Clinical exam/history: The patient was not a user of tobacco or alcohol. Extraoral image revealing facial asymmetry, right side volume increase, alar nose elevation and the erasing of the nasolabial furrow. The InTraOral examination is showing an involved right side of the maxilla, extending to the left side of the palate. In the intraoral physical examination, there was an increase in volume in the hard palate (Figure 1B). The central and upper right lateral incisors presented mobility.

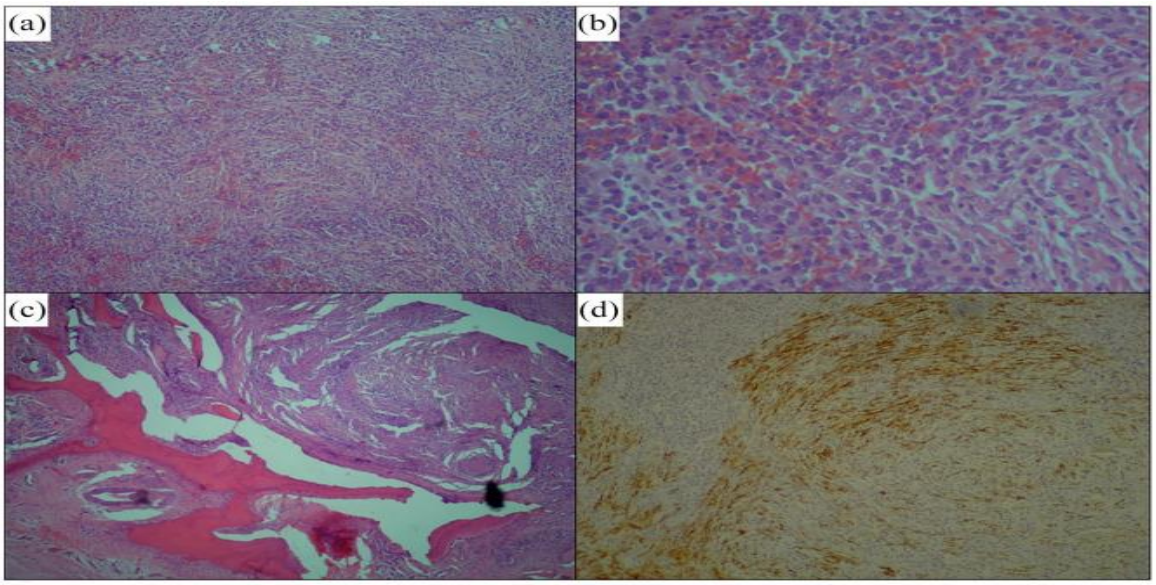
Radiographic Research:

*Orthopantomogram*: A panoramic view showed a multilocular radiolucent lesion mainly in the right side of the maxilla, extending across the midline to involve the left side.

*CBCT*: Axial slice computed tomography (CT) scans were carried out, revealing an oval corticated lucency occupying a large portion of the right maxillary sinus (Figure 2A ) and expansion and destruction of the alveolar cortical plate, involving the nasal cavity and the eyeball. The coronal slice showed a large, expansile, multilobulated cystic lesion of the maxilla (Figure 2B).

## 6th: Pseudo-Tumoral Conditions




(34)Al Khader A, Odeh H, Nsour E, Al Awamleh AGI. Intraosseous inflammatory pseudotumor of the maxilla: a case report. SAGE Open Med Case Rep. 2022;10:2050313X221091670. doi:10.1177/2050313X221091670. PMCID: PMC9019325.

Patient Age/sex: 52 year-old Women

Location: Lesion located anterior to the inferior aspect of the left maxillary sinus

Symptoms/history: history of recurrent dental infections with transient improvement by antibiotics. However, the symptoms became refractory to antibiotic treatment

Complementary infos: An incisional biopsy was performed, and histopathological examination revealed a cellular lesion comprising spindle cell fascicles in a background of fibrotic stroma and areas akin to a storiform pattern. (Figure 1)

Radiographic research:

*CBCT*: scan revealed a 3-cm-sized osteolytic maxillary lesion  CT and intraoperative findings also showed infiltrative tumor behavior. The patient underwent partial maxillectomy , and there was no evidence of recurrence during the 4-month follow-up period. (Figure 2)