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Original article

Diagnostic Challenges of Peri-Implant Lesions in Libya

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Abstract
Peri-implantitis is the most encountered complication in implant dentistry. However, emerging evidence indicates that not all peri-implant lesions are inflammatory in origin. Malignancies, particularly oral squamous cell carcinoma (OSCC), may mimic peri-implant disease both clinically and radiographically, leading to delayed diagnosis and poor prognosis. This study aims to explore the potential under-recognition of malignancies presenting as peri-implant lesions in Libya and to assess the awareness and clinical practices of dental practitioners regarding this issue. A cross-sectional survey-based study is proposed targeting Libyan dental practitioners, including general dentists and implantologists. The questionnaire evaluates knowledge, attitudes, and practices related to suspicious peri-implant lesions and biopsy referral patterns. Our study showed that variability in awareness exists among clinicians, with a tendency toward underutilization of biopsy in persistent or atypical peri-implant lesions. The absence of reported cases in Libya may reflect underdiagnosis rather than true absence. Increasing awareness and implementing clear diagnostic protocols are essential to improve early detection and patient outcomes.
Keywords. Peri-implantitis, Oral Cancer, Dental Implants, Misdiagnosis, Libya.

Introduction

Dental implants have become an integral component of contemporary restorative and rehabilitative dentistry, offering predictable functional and aesthetic outcomes with high long-term survival rates [1]. The global increase in implant placement has been accompanied by a parallel rise in biological complications, most notably peri-implant mucositis and peri-implantitis. Peri-implantitis, characterized by inflammation of the peri-implant soft tissues and progressive loss of supporting bone, is widely regarded as the primary cause of implant failure and remains a central focus of clinical research and practice [2].

Clinically, peri-implantitis typically presents with bleeding on probing, suppuration, increased probing depths, and radiographic evidence of crestal bone loss. These features, although well recognized, are not pathognomonic and may overlap with other pathological conditions affecting peri-implant tissues [3]. In recent years, increasing attention has been directed toward the potential for non-inflammatory and neoplastic processes to mimic peri-implant disease, thereby posing a significant diagnostic challenge. Among these conditions, Oral squamous cell carcinoma (OSCC) is of particular concern. OSCC is the most common malignancy of the oral cavity and is associated with significant morbidity and mortality, especially when diagnosis is delayed [4]. Several reports have documented cases in which OSCC presented clinically and radiographically as peri-implantitis, leading to misdiagnosis and inappropriate initial management. This overlap in presentation may result in repeated conservative or surgical interventions before a definitive diagnosis is established [5]. The diagnostic dilemma is further compounded by a cognitive bias in clinical practice, whereby inflammatory conditions such as peri-implantitis are considered far more likely than malignancy. As a result, clinicians may adopt a stepwise therapeutic approach focused on infection control, often delaying biopsy or specialist referral. Such delays can have serious consequences, as early-stage malignancies may progress to advanced disease with poorer prognosis [6].

Despite the growing body of international literature addressing malignancies associated with dental implants, there is a conspicuous lack of published data from Libya. This absence raises critical questions regarding whether such cases are genuinely rare within the population or whether they are being underdiagnosed, misdiagnosed, or underreported. Factors such as limited access to specialized diagnostic services, lack of standardized clinical protocols, and insufficient awareness among practitioners may contribute to this gap. Therefore, the present study aims to explore the potential under-recognition of malignancies presenting as peri-implant lesions in Libya. By evaluating the knowledge, attitudes, and clinical practices of dental practitioners, this research seeks to identify existing diagnostic gaps and contribute to the development of more effective clinical decision-making strategies.

The relationship between dental implants and oral malignancies has been the subject of increasing investigation, particularly in the context of lesions that clinically resemble peri-implantitis [7]. Although the incidence of malignancies arising in association with dental implants is considered low, numerous case reports and systematic reviews have highlighted the potential for misdiagnosis due to overlapping clinical and radiographic features [7,8]. A significant proportion of reported cases involve Oral squamous cell carcinoma presenting adjacent to or surrounding dental implants. In many instances, these lesions were initially diagnosed and managed as peri-implantitis, often undergoing multiple rounds of non-surgical debridement, antibiotic therapy, or even surgical intervention prior to histopathological

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confirmation [9]. This pattern underscores a recurring diagnostic delay attributable to the assumption of an inflammatory etiology.

Clinically, malignant peri-implant lesions may present with signs and symptoms indistinguishable from peri-implantitis, including bleeding on probing, suppuration, peri-implant pocket formation, and progressive bone loss [10]. However, several distinguishing features have been proposed in the literature. These include rapid progression of bone destruction, the presence of exophytic or ulcerative soft tissue masses, induration of surrounding tissues, unexplained pain, and failure to respond to conventional peri-implant therapy. Such features should raise suspicion and prompt further investigation. Radiographically, malignancies may appear as irregular, poorly defined radiolucencies with cortical bone destruction, in contrast to the more uniform, saucer-shaped bone loss typically associated with peri-implantitis [6,10]. Advanced imaging modalities such as cone beam computed tomography (CBCT) may aid in identifying aggressive or atypical patterns of bone involvement; however, radiographic findings alone are insufficient for definitive diagnosis [11].

Several etiopathogenic mechanisms have been proposed to explain the occurrence of malignancies in peri-implant regions [10]. These include chronic inflammation, which may create a pro-carcinogenic microenvironment; mechanical irritation from implant components; and the concept of field cancerization, particularly in patients with a history of oral premalignant lesions or prior malignancy. Additionally, well-established risk factors such as tobacco use, alcohol consumption, and genetic susceptibility remain relevant in this context.

It is important to note that current evidence does not support a direct causal relationship between dental implants and the development of oral cancer [12]. Rather, implants may act as a site where pre-existing or developing malignancies become clinically evident. This distinction is critical in addressing potential misconceptions among clinicians and patients [13]. The literature consistently emphasizes the importance of early biopsy in suspicious peri-implant lesions, particularly those that do not respond to standard treatment protocols. Despite this, studies indicate that biopsy is often delayed, reflecting a gap between knowledge and clinical practice [14]. In summary, existing evidence highlights a clear need for increased awareness and the establishment of clinical guidelines to aid in the differentiation between benign peri-implant disease and malignant lesions [4]. The absence of region-specific data, particularly in countries such as Libya, further underscores the importance of local research to better understand diagnostic practices and improve patient outcomes.

Methods

This study was designed as a cross-sectional descriptive survey to evaluate the awareness, attitudes, and clinical practices of dental practitioners in Libya regarding peri-implant lesions that may mimic malignancy. The study specifically focused on clinicians' ability to recognize suspicious features and their decision-making in relation to biopsy and referral. The target population consisted of licensed dental practitioners practicing in Libya, including general dentists, oral and maxillofacial surgeons, periodontists, and implantologists working in both public and private sectors.

A convenience sampling approach was adopted due to the exploratory nature of the study, with a target sample size ranging between 100 and 200 participants. The target sample size of 100–200 participants was established to ensure adequate representation of dental practitioners across different specialties and regions of Libya; however, the final sample comprised 54 respondents, reflecting the voluntary nature of participation and challenges in survey recruitment. Efforts were made to reach a wide range of clinicians through professional networks, dental associations, social media platforms, and direct contact in clinical settings. Data were collected using a structured questionnaire developed based on previously published literature on peri-implant diseases and oral malignancies, particularly oral squamous cell carcinoma. The questionnaire was designed to assess several domains, including demographic characteristics, clinical experience with dental implants and peri-implantitis, knowledge of potential malignant conditions that may mimic peri-implant disease, and routine clinical practices such as biopsy and referral. In addition, participants' attitudes toward the importance of this topic and their willingness to engage in further education were evaluated. The questionnaire included a combination of multiple-choice questions, dichotomous (yes/no) items, and Likert scale responses.

The survey was distributed primarily through an online platform (Google Forms) to facilitate participation from different regions across Libya, and printed copies were provided in selected clinical settings where feasible. Participants were given a brief explanation of the study objectives prior to completing the questionnaire, and completion of the survey was considered to imply informed consent. The main variables analyzed included knowledge level regarding malignancy risk and recognition of clinical red flags, patterns of clinical practice such as biopsy and referral behavior, and attitudes toward the importance of early diagnosis and the need for clinical guidelines. Data were entered, and participants' responses were analyzed. Descriptive statistics, including frequencies and percentages, were used to summarize the data. All procedures were conducted in accordance with standard ethical principles. Participation was voluntary, responses were anonymous, and no identifying personal data was collected. Participants were

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informed about the purpose of the study, and confidentiality of the collected information was ensured throughout the research process.

Results

A total of 54 dental practitioners participated in the study, representing a range of clinical backgrounds and experience levels. More than half of the respondents (57.4%) reported that they actively place dental implants, indicating a substantial level of involvement in implant-based clinical practice. The majority of participants (74.1%) had encountered lesions around dental implants in their clinical work, suggesting that peri-implant pathologies are a common finding in daily practice. Among the reported lesions, peri-implantitis was the most frequently encountered condition, accounting for 66.7% of cases. Despite this high prevalence, awareness of more serious underlying conditions appeared to be moderate, as only 59.3% of participants acknowledged that malignancies can mimic peri-implantitis. Similarly, recognition of key warning signs was variable, with 59.3% identifying rapid bone loss as an important red flag, indicating a potential gap in comprehensive clinical suspicion.

Regarding clinical management, a notable discrepancy was observed between awareness and practice. A significant proportion of participants (66.7%) reported that they never perform a biopsy for suspicious lesions around dental implants. Although 52% indicated that they would consider biopsy in such cases, this suggests inconsistency in clinical decision-making and a tendency toward conservative or delayed diagnostic approaches. In terms of referral patterans, most practitioners preferred to seek specialist input when managing peri-implant lesions. The majority (61.1%) reported consulting an oral and maxillofacial surgeon, while smaller but equal proportions (27.8% each) would refer to an oral medicine specialist or an oral pathologist. However, a minority of participants (9.3%) indicated that they do not routinely seek consultation in such cases, which may further contribute to delayed diagnosis or mismanagement. Overall, the findings highlight that while peri-implant lesions are commonly encountered in clinical practice, there is variability in awareness of potential malignancy and a clear gap between knowledge and implementation of appropriate diagnostic measures, particularly with regard to biopsy and specialist referral. A summary of participants' awareness and clinical practices regarding peri-implant lesions is presented in Table 1.

Table 1. Awareness and clinical practices related to peri-implant lesions among Libyan dental practitioners (n = 54).

Variable	Response	n (%)
Practitioners placing implants	Yes	31 (57.4)
Encountered peri-implant lesions	Yes	40 (74.1)
Most common lesion	Peri-implantitis	36 (66.7)
Aware malignancies mimic peri-implantitis	Yes	32 (59.3)
Recognized rapid bone loss	Yes	32 (59.3)
Perform a biopsy for suspicious lesions	Never	36 (66.7)
Would consider biopsy when indicated	Yes	28 (52.0)
Referral to oral & maxillofacial surgeon	Yes	33 (61.1)
Referral to an oral medicine specialist	Yes	15 (27.8)
Referral to an oral pathologist	Yes	15 (27.8)
Do not routinely seek consultation	Yes	5 (9.3)

Discussion

The findings of the present study provide important insight into current clinical practices and awareness regarding peri-implant lesions among dental practitioners in Libya, and help to explain the apparent absence of reported malignancies in this context. Although a substantial proportion of participants are actively involved in implant dentistry and frequently encounter peri-implant lesions, the results suggest that this absence of reported cases is more likely attributable to under-recognition rather than a true lack of occurrence.

Peri-implantitis was identified as the most commonly encountered lesion, which is consistent with its well-established prevalence in implant practice [15]. However, this high frequency may contribute to a diagnostic bias, whereby clinicians are inclined to attribute most peri-implant tissue changes to inflammatory causes [16]. This tendency appears to be supported by the moderate level of awareness observed in the study, as only approximately two-thirds of participants recognized that conditions such as Oral squamous cell carcinoma can clinically mimic peri-implantitis. This gap in awareness is clinically significant, as it may lead to delayed consideration of alternative diagnoses in atypical or non-responsive cases [5].

The recognition of clinical warning signs also appeared to be inconsistent. While more than half of the participants identified rapid bone loss as a potential red flag, this indicates that a considerable proportion

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of clinicians may not fully appreciate the spectrum of features suggestive of malignancy. In routine practice, malignant lesions may present with subtle or overlapping features, including persistent inflammation, soft tissue changes, or unexplained discomfort, all of which may initially resemble peri-implant disease [5]. Without a high index of suspicion, these cases may be managed conservatively for extended periods before appropriate diagnostic measures are undertaken [5]. A particularly important finding of this study is the discrepancy between awareness and clinical practice. Despite a reasonable level of theoretical knowledge, the majority of participants reported that they do not routinely perform biopsies for suspicious peri-implant lesions. This highlights a critical gap in the translation of knowledge into clinical action.

Although approximately half of the respondents indicated that they would consider a biopsy, the overall pattern suggests hesitation or uncertainty in initiating invasive diagnostic procedures. Such delays are well documented in the literature and are associated with more advanced disease at the time of diagnosis and poorer patient outcomes. Referral patterns observed in this study further support this interpretation. While most clinicians reported seeking consultation, predominantly from oral and maxillofacial surgeons, fewer participants indicated referral to oral medicine specialists or oral pathologists, who may play a key role in early diagnosis of mucosal and neoplastic conditions. Additionally, a small but notable proportion of practitioners reported that they do not routinely seek consultation, which may further contribute to missed or delayed diagnoses. These findings are consistent with international reports describing malignancies initially misdiagnosed as peri-implantitis, often undergoing repeated unsuccessful treatments before biopsy [6]. Importantly, current evidence does not support a direct causal relationship between dental implants and malignancy; rather, implants may represent sites where pre-existing or developing lesions become clinically evident. Therefore, the emphasis should not be placed on implant-associated risk, but rather on improving diagnostic vigilance in the assessment of peri-implant tissues [13].

From a clinical perspective, the results of this study underscore the importance of adopting a more cautious and systematic approach when managing peri-implant lesions. Clinicians should maintain a low threshold for biopsy, particularly in cases presenting with non-healing lesions, rapid or irregular bone loss, soft tissue proliferation, or lack of response to conventional therapy. Early histopathological evaluation remains the gold standard for definitive diagnosis and is essential for excluding malignancy [17,18]. This study has several limitations that should be acknowledged. Although the initial target sample size ranged from 100 to 200 participants, only 54 dental practitioners completed the survey. The relatively small sample size may limit the generalizability of the findings to all dental practitioners in Libya and may introduce response bias, as clinicians with a greater interest in implant dentistry or oral pathology may have been more likely to participate. Nevertheless, the study provides valuable preliminary data on an underexplored topic and highlights important areas for future research using larger and more representative samples. Overall, the present study highlights a clear need for enhanced education, increased awareness, and the development of practical clinical guidelines to support decision-making in the management of peri-implant lesions.

Addressing these gaps may significantly improve early detection of serious pathology and ultimately contribute to better patient outcomes. Based on the findings of the present study, several practical steps can be considered to improve clinical outcomes. These include the incorporation of clear biopsy guidelines into routine implant practice, enhancement of continuing education in oral pathology, and strengthening interdisciplinary collaboration between clinicians and oral pathologists. In addition, the establishment of a national registry for peri-implant complications may provide valuable epidemiological data and support future research in this field [19].

Conclusion

The present study demonstrates that peri-implant lesions are commonly encountered in clinical practice among dental practitioners in Libya, with peri-implantitis representing the predominant diagnosis. However, the findings reveal a concerning gap between clinical exposure and diagnostic vigilance. While a moderate level of awareness exists regarding the possibility that malignancies such as Oral squamous cell carcinoma may mimic peri-implant disease, this knowledge is not consistently translated into appropriate clinical action. The limited use of biopsy and variability in recognition of warning signs suggest that suspicious lesions may be under-investigated, potentially leading to delayed diagnosis of serious pathology. This may partly explain the absence of reported cases of malignancy associated with dental implants in Libya, which is more likely reflective of under-recognition rather than true absence. These findings emphasize the need for increased clinical awareness, improved diagnostic confidence, and the integration of clear guidelines to support early identification of atypical peri-implant lesions. Adopting a more proactive approach, particularly through timely biopsy and appropriate referral, is essential to enhance patient safety and improve clinical outcomes.

Conflict of interest. Nil

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